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# Design of Android Application for Curing of Concrete

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**ABSTRACT:** In the present world due to the rising of the construction field at a rapid rate the demand for manpower and resources has increased over a period of time. By taking this in mind the project topic which was selected to work was regarding Curing and. In this particular project the major concentration will be given to understand the behavior of the concrete for different water supplies from least to the excess. Based on the observations made on this behavior suitably a device will be developed and will be connected to an application so as to have an automation i.e. in order to perform scientific curing. Efficient uninterrupted curing is the key to quality concrete. Proper curing of concrete is crucial to obtain design strength and maximum durability. The curing period depends on the required properties of concrete, the purpose for which it is to be used, and the surrounding atmosphere namely temperature and relative humidity. The article presents an overview of the ways the. Internet of Things (IoT) is currently used to solve urban issues and support construction projects. Previously only few research have been done on Design of Android Application for curing of concrete. This project mainly focuses on percentage of humidity and temperature during the process of curing.

## I. INTRODUCTION

Curing is the name given to the procedures used for promoting the hydration of the cement, and consists of a control of temperature and of moisture movement from and into the concrete. Curing allows continuous hydration of cement and consequently continuous gain in the strength, once curing stops strength gain of the concrete also stops. Proper moisture conditions are critical because the hydration of the cement virtually ceases when the relative humidity within the capillaries drops below 80% desirable strength and impermeability. The continuous pore structure formed on the near surface may allow the ingress of deleterious agents and would cause various durability problems. Moreover due to early drying of the concrete micro-cracks or shrinkage cracks would develop on surface of the concrete. When concrete is exposed to the environment evaporation of water takes place and loss of moisture will reduce the initial water cement ratio which will result in the incomplete hydration of the cement and hence lowering the quality of the concrete. Various factors such as wind velocity, relative humidity, atmospheric temperature, water cement ratio of the mix and type of the cement used in the mix will affect the curing of concrete. Evaporation in the initial stage leads to plastic shrinkage cracking and at the final stage of setting it leads to drying shrinkage cracking.

Curing temperature is one of the major factors that affect the strength development rate. At elevated temperature ordinary concrete losses its strength due to the formation of the cracks between two thermally incompatible ingredients, cement paste and aggregates. When concrete is cured at high temperature normally develops higher early strength than concrete produced and cured at lower temperature, but strength is generally lowered at 28 days and later stage. A uniform temperature should be maintained through the concrete section to avoid thermal cracking. Laboratory tests show that concrete in dry environment can lose as much as 50 percent of its potential strength compared to similar concrete that is moist cured.

Nowadays, studies into concrete durability are no longer limited to a single environment but can be performed taking multiple factors into consideration. Through experiments using three types of dry and wet circulation systems, determined the deterioration law for concrete under load, carbonation, and exposure to chloride. Found



that the results obtained from laboratory based, single factor, concrete-accelerated deterioration studies are significantly different from those from exposure, and, for physical test, the combined action of multiple factors should be considered; these studies show that the durability of the material and structure of concrete is affected by the combined action multiple factors.

Concrete is widely used in construction because of its versatility, strength, durability, and flexibility. To reach its best performance, proper concrete curing is required during the concrete hardening process, as the hydration reaction between water and cement takes place. Both the moisture content within the concrete and the temperature, during hardening, are critical parameters determining the quality of the concrete. The moisture content correlates to the degree to which all the cement particles are actually hydrated in the setting process, and the temperature determines the speed of the reaction. As such, to maintain suitable levels of hardening concrete moisture content and temperature, it is essential that the moisture content and temperature of the external air surrounding the hardening concrete, the surrounding environmental conditions, are continuously controlled. Any water loss by evaporation, which relates directly to wind speed, temperature, and humidity, must be avoided. Concrete curing is the process by which the moisture content and temperature of fresh concrete is maintained. The rate of hydration reaction depends on temperature. The higher the temperature, the faster the hydration process. Although the hydration process can be accelerated by high temperature, the early ultimate strength of concrete is low due to incomplete development of the hydration process.

## II. PROBLEM STATEMENT

Now a days India is facing water as well as electricity problem. Due to lockdown, most of labours get settled at their home town for their job or day to day work. So to overcome water problem at site we can minimize use of water with this project and also efficient way of use of electricity. With this sensor we can track the perfect content of water required and also curing is done properly or not as well as requirement of labour gets reduced and we can get all data just by single click on our application.

## III. METHODOLOGY

In this project for curing we did different experiments in order to determine the efficient method of curing and minimum amount of water required for crop. So for curing we casted 2 moulds and fixed 3 temperature sensors to know the heat of hydration and one sensor to know the surface temperature and humidity. Based on these value we prepared one device that will be monitored and controlled by the android device.

1. Setup the water content measuring sensor in the respective place.
2. Connect the Arduino to the sensor.
3. Setup the limit for the water sensor using the Arduino.
4. Connect the relay to Arduino.
5. Connect the wi-fi module to the Arduino so that the Arduino can be controlled using an android application.
6. Now you can regulate the water flow based on sensor data and also, we can supply water whenever needed remotely using an android application.

## IV. LITERATURE REVIEW

Gokhale et al. wrote that the “Internet of Things (IoT) is a network of physical objects, such as devices, instruments, vehicles, buildings, and other items, with embedded electronics, circuits, software, sensors, and network connectivity that enable these objects to collect and exchange data.” The IoT is generally defined as “dynamic global network infrastructure with self-configuring capabilities based on standards and communication protocols.” The IoT is able to sense and control the physical world remotely through the integration of computer-based systems to increase the efficiency and accuracy of the activities concerned. Arslan et al. summarised 12 IoT application studies in construction. They concluded that IoT benefits the construction industry in decision-making, BIM integration, health and safety issues, progress tracking, and real-time monitoring. Safety due to accurate and efficient communication required strong progress tracking and realtime monitoring. One real-life



application is to use an IoT wearable device which detects the health (heartbeat and body temperature) of construction workers. Any abnormal body conditions caused by construction accidents, say fever, will trigger the IoT device to alert of any unhealthy body condition. A limited number of researchers have applied IoT technology to concrete structures monitoring Taffese et al. indicated the possibility of adopting IoT for structural condition assessment. An automatic system for monitoring concrete temperature, air temperature, and humidity ranges should enable the maturity of concrete and its strength to be predicted. Thus, a user-friendly Internet/mobile IoT system was invented for the purposes of monitoring the early stages of concrete hydration and hardening formation. This paper reports on the subsequent study made of its performance in practice. Yang et al. also indicated that concrete could reach a high compressive strength under conditions of a rigorously controlled relative humidity and temperature. They highlighted that the manual-based curing limitation, particularly pointing out that the difficulty in ensuring constant and stable curing intervals between manual sprays, will result in a reduced quality of concrete. Since the IoT-based curing system helps to maintain stable concrete temperature, the risk of crack occurrence can be reduced leading to a higher quality concrete. Kholia et al. concluded that traditional water curing is generally more effective than membrane curing and accelerated curing in terms of water retention. Sprinkling and wet covering are more commonly used water curing methods on site with fewer limitations. However, sprinkling and wet covering are less efficient than ponding and immersion due to the strict concrete surface wetting and drying requirements and the considerable amount of labour needed. Thus, an IoT-based concrete curing device will be beneficial in improving the efficiency and quality of concrete curing and in replacing the complicated manual operations.

The IoT-based concrete curing system proposed by Yang et al. applied the hydration heat release law as its working principle. Temperature and relative humidity sensors are used, and a track is kept on whether the humidity at the concrete surface is greater than 80%. The strength and microstructure of concrete and mortar are known to be affected by drying process. Removal of significant amounts of water from cement paste before maturation, in inadequate curing conditions results in inferior properties and poor performance. Furthermore, the mechanical properties of a cement-based material at any age are generally a function of its moisture content. Drying shrinkage influences the microstructure in many levels and, it affects the mechanical properties in two basic ways. In one respect, it tends to increase strength by increasing surface energy and increasing bonding between particles of calcium silicate hydrate (C-S-H). In another respect, since it is a quasi-brittle material, the strength is reduced by microcrack formation.

The well-known effect of temperature on the mechanical properties of cementitious materials was observed under high relative humidity conditions especially at early ages if there is sufficient water in the capillary pores even under low relative humidity conditions. The early strength values were higher at warmer conditions compared to the cooler conditions. The hydration process and increase of strength developed continuously under high relative humidity regimes up to 75%. Concrete is an aging material, and the hydration-related properties of concrete change with time. Meanwhile, the heat of hydration in mass concrete structures creates a temperature gradient between the inner and surface. This temperature gradient affects the properties of the concrete, i.e., the compressive strength, elastic modulus, splitting tensile strength, and autogenous shrinkage. Also, the temperature variations caused by cold-weather or hot weather conditions have the same influence on concrete. Hydration properties such as the compressive strength, elastic modulus, splitting tensile strength, and autogenous shrinkage are factors that must be considered in the design and construction of concrete structures. Temperature has a considerable influence on the mechanical properties of early-age concrete. Mechanical properties such as compressive strength are factors to be considered in the design and construction of concrete structures. Therefore, the effects of temperature and aging on the mechanical properties should be studied and quantified. According to the experimental results, concrete subjected to high temperatures at early ages attains higher early-age compressive and splitting tensile strengths but has lower later-age compressive and splitting tensile strengths than concrete subjected to normal temperature.



## V. CONCLUSION & RESULTS

### MANUAL BASED READINGS

| Days | Moisture | Strength  |
|------|----------|-----------|
| 7    | 52%      | 16.5 N/mm |
| 14   | 45%      | 20 N/mm   |
| 28   | 32%      | 22.2 N/mm |

### IOT BASED READINGS

| Days | Moisture | Strength  |
|------|----------|-----------|
| 7    | 55%      | 16.8 N/mm |
| 14   | 40%      | 21.7 N/mm |
| 28   | 28%      | 23.4 N/mm |

We performed Strength test under UTM and results are discussed above.  
It shows the strength and difference between manual and IoT based curing.  
IoT device curing is more efficient than manual curing as it affects the strength of cube.

## REFERENCES

1. Internet of Things-Based Concrete Curing Invention for Construction Quality Control,(King-Chi Lo, Heung-Wing Terry Kwok, Ming-Fung Francis Siu, Qiping Geoffrey Shen, and Chi-Keung Lau)
2. The effect of curing temperature and relative humidity on the strength development of Portland cement mortar (Hayri UN and Bulent BARADAN)
3. Effect of Curing Temperature on the Durability of Concrete under Highly Geothermal Environment,(Yang Tang, Hui Su, Shun Huang, Chunlai Qu, and Jiaqi Yang)
4. Prediction of Temperature and Aging Effects on the Properties of Concrete,(Jin-Keun Kim and Inyeop Chu)  
Curing of Concret,(Shaikh A.S., Lahare P.S., Nagpure V.B. Ghorpde S.S)



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