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# Development of the Maturity Sensor Prototype and Method of Its Placement in the Structure

**Authors :** Yelbek B. Utepov, Assel S. Tulebekova, Alizhan B. Kazkeyev

**Abstract :** Maturity sensors are used to determine concrete strength by the non-destructive method. The method of placement of the maturity sensors determines their number required for a certain frame of a monolithic building. Previous studies weakly describe this aspect, giving only logical assumptions. This paper proposes a cheap prototype of an embedded wireless sensor for monitoring concrete structures, as well as an alternative strategy for placing sensors based on the transitional boundaries of the temperature distribution of concrete curing, which were determined by building a heat map of the temperature distribution, where unknown values are calculated by the method of inverse distance weighing. The developed prototype can simultaneously measure temperature and relative humidity over a smartphone-controlled time interval. It implements a maturity method to assess the in-situ strength of concrete, which is considered an alternative to the traditional shock impulse and compression testing method used in Kazakhstan. The prototype was tested in laboratory and field conditions. The tests were aimed at studying the effect of internal and external temperature and relative humidity on concrete's strength gain. Based on an experimentally poured concrete slab with randomly integrated maturity sensors, it was determined that the transition boundaries form elliptical forms. Temperature distribution over the largest diameter of the ellipses was plotted, resulting in correct and inverted parabolas. As a result, the distance between the closest opposite crossing points of the parabolas is accepted as the maximum permissible step for setting the maturity sensors. The proposed placement strategy can be applied to sensors that measure various continuous phenomena such as relative humidity. Prototype testing has also revealed Bluetooth inconvenience due to weak signal and inability to access multiple prototypes simultaneously. For this reason, further prototype upgrades are planned in future work.

**Keywords :** heat map, placement strategy, temperature and relative humidity, wireless embedded sensor
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