AUTOMATED MOISTURE CONTROL FOR CURING USING SENSORS

***T.JAMES KEVIN CHRISTY, *R.MAHESH, *K.GOKUL KRISHNA, *Ms.HariNarayanee.P**

**CIVIL DEPARTMENT*
KCG COLLEGE OF TECHNOLOGY
Chennai-97

ABSTRACT

Curing is a process which protects the concrete from loss of moisture. Maintaining optimum moisture in the concrete can enhance the strength of concrete and also avoid the crack formation. In the conventional method curing is done manually which is a tedious and expensive process. In the present study, an attempt in lab scale level has been made to fully automised curing process using pumps and sensors. This process minimized the labor involved in the curing process. An optimum moisture level of 80% was achievable throughout the curing process.Curing is usually done in two major methods on site, splashing water on the concrete formation manually using hand held hose pipes or using some sort of textile cover that retains the water sprayed for a period of time, like a jute bag or hessian. These methods have their own disadvantages like they are expensive and use more quantity of water. This is where the idea of AUTOMATED CURING PROCESS is put to use. Spraying water on the concrete formation using water pump, sensors, microcontroller, thus making it a fully automated process.

Keywords: Moisture sensor, Arduino, Pump.

IJAER

INTRODUCTION:

The process is done using moisture sensors, microcontroller and a water pump.

The moisture sensor is planted in the fresh concrete block this gives the moisture content of the block, the moisture sensor is connected to a microcontroller, which is then connected to water pump through a relay, which triggers the motor pump depending on the values received from the moisture sensor.

ANALYSIS:

Analysis have been made in laboratory using testing cubes of M_{20} grade concrete, The following analysis are made and studied, The concrete's water absorption limit for a period of time, The time for the concrete to become fully dry after curing, The time taken for water to fully penetrate into the concrete. By studying the collected data the curing pattern for a concrete is set.

Table 1: Water absorption of concrete.

CONCRETE	INITIAL WATER CONTENT	FINAL WATER CONTENT	TIME	WATER ABSORPED
M_{20}	6000ml	5900ml	24hours	100ml

Initially two cubes are moulded in the conventional casting apparatus of M_{20} concrete, the first cube is cured in the Curing tank by fully immersing it in water for 28 days, the second cube was cured using the Automated System for 28 days and finally their compression test values are recorded.

Table 2: Compression test results.

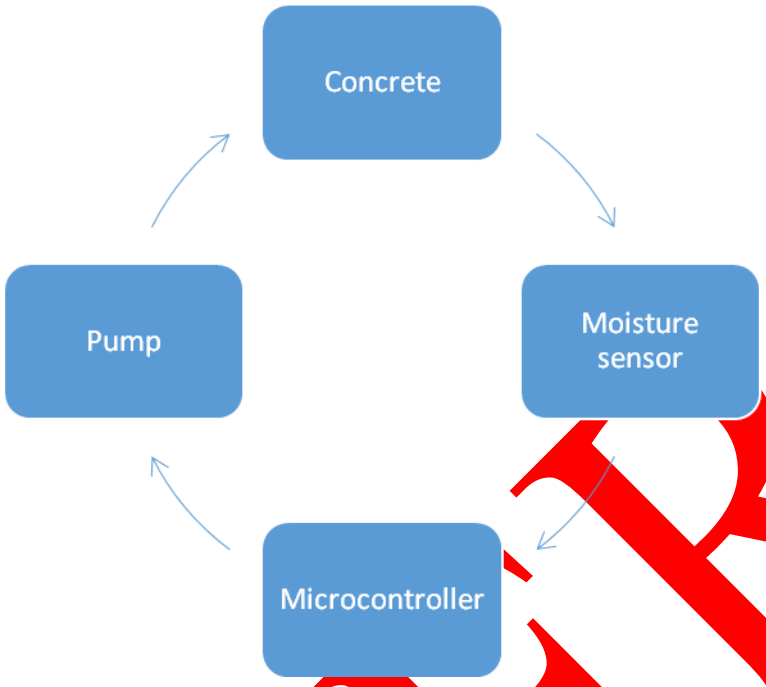
Cube	Strength KN/m
Cube 1 (Curing tank)	20.1
Cube 2 (Automated System)	21.3

METHODOLOGY:

The principle for automatic curing is, the moisture sensor transmits the moisture content in the concrete structure to the Microcontroller, the Microcontroller triggers the pump based on the values transmitted from the sensors.

The optimum moisture content that has to be maintained for concrete during the period of curing is 80%. A triggering value is set in the Microcontroller based on this optimum moisture content, Therefore if the moisture value becomes lesser than the triggering value, the Microcontroller triggers the pump (ON), After water being sprayed, the sensors now detect the moisture content in the concrete if it is higher, the Microcontroller again triggers the pump (OFF), thus the process is cycled.

IJAER



EXPERIMENTAL PROCEDURE:

The experiment is performed in lab scale level, a 1mx1m slab of thickness 70mm is casted, The moisture sensor is placed at the centre of the slab.

Fig. 1 Freshly casted slab

Fig. 2: Moisture sensor embedded in Concrete

The Microcontroller is connected to the sensors and water pump, A 5V relay is used to connect the pump and microcontroller. The working parameters are programmed in the microcontroller. An Arduino Uno R3 development board is used as a microcontroller and using the board software the program is uploaded in it.

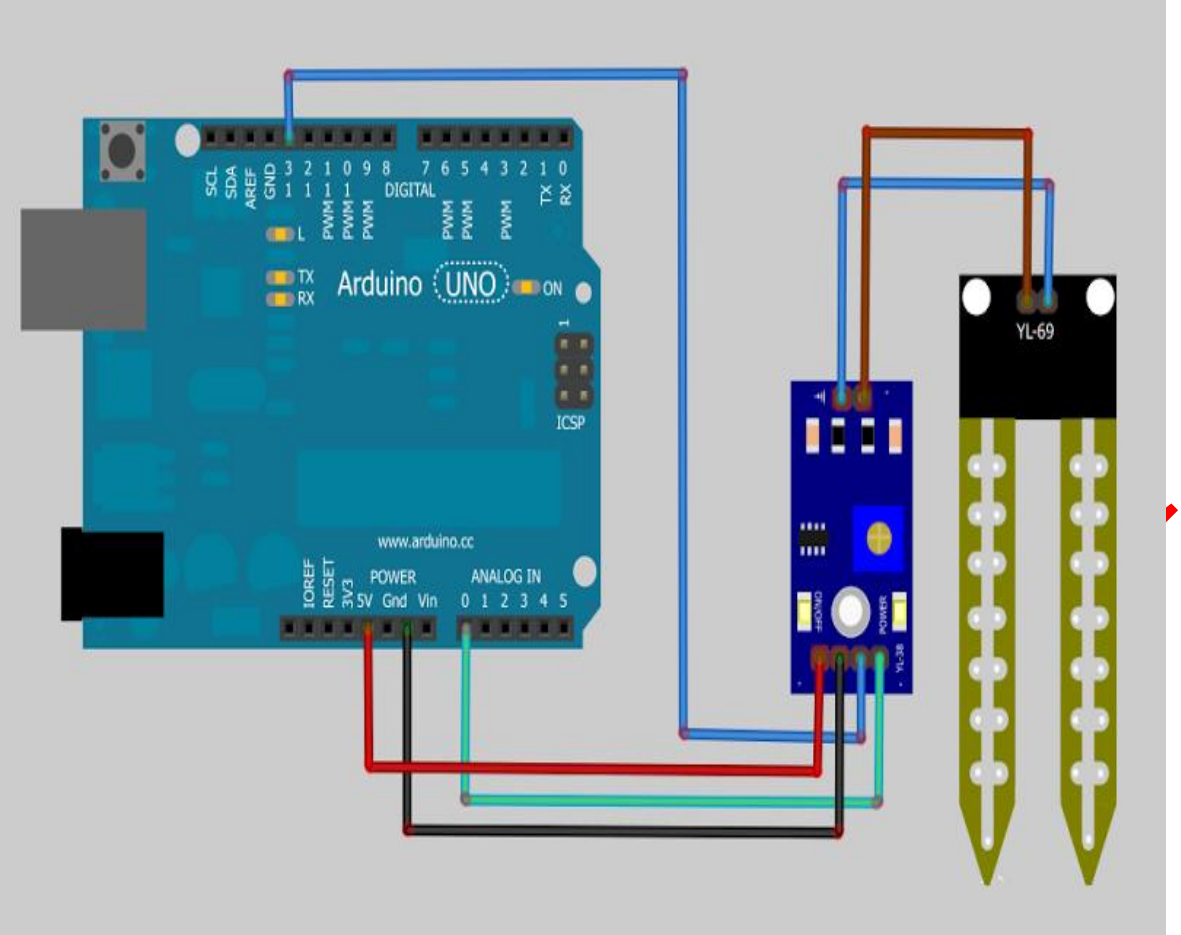


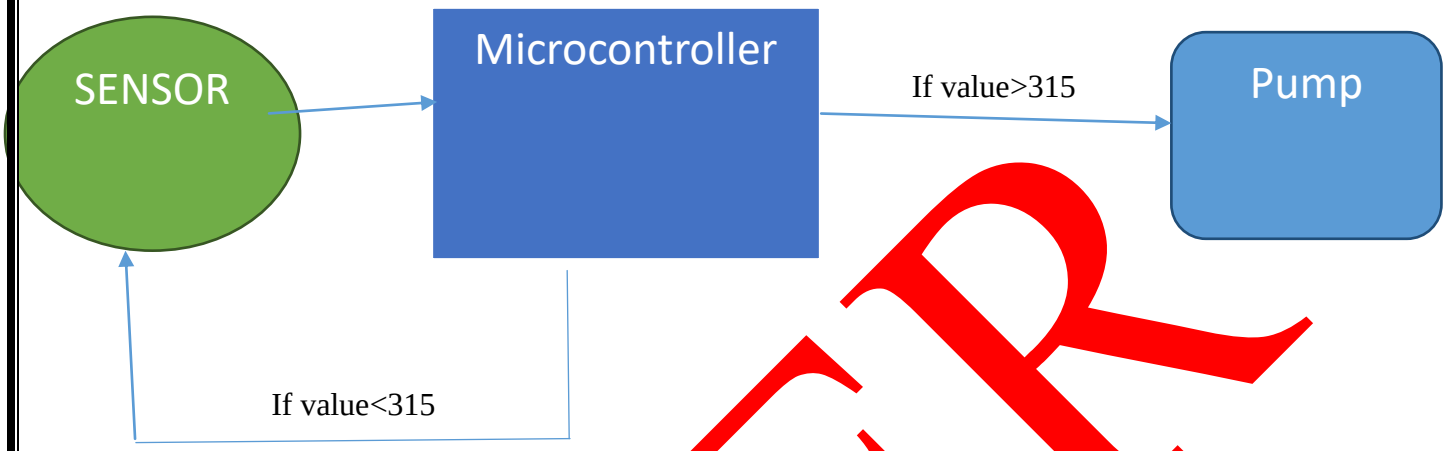
Fig. 3: Circuit diagram of Microcontroller

The initial arrangements are made, with this setup, the sensors start to transmit the values to the microcontroller, the driest (HIGHEST) and fully saturated (LOWEST) values for the sensors are recorded and tabulated. The values that are received from the sensors are the measure of resistivity in the water so, if there is more water content there will be less resistivity and vice versa.

Table 3: Resistivity measured from the sensors.

STATE	**SENSOR VALUES**
DRY	360
SATURATED	234

To maintain the optimum moisture content of 80% a triggering value is set at **315** i.e. if the sensor value becomes higher than 315 the pump will be turned ON, if the sensor value is low It will be automatically turned OFF.This trigger value can be adjusted as per the users requirement and the environmental condition of the site.



IJAER

LAYOUT OF PIPES AND SENSORS:

The pipes that are connected to the pump outlet are laid across the perimeter of the slab for even distribution of water.

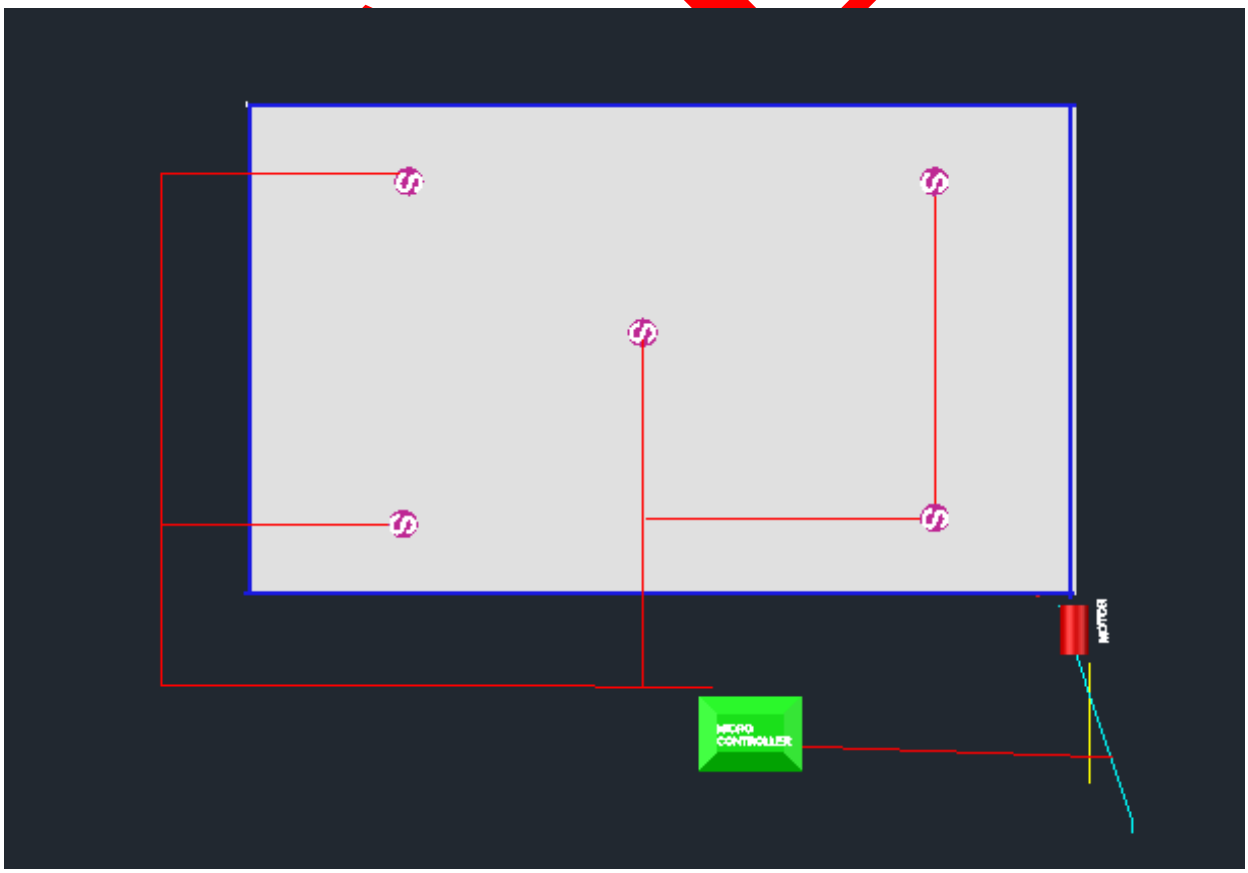


Fig. 4: Layout for placement of sensors

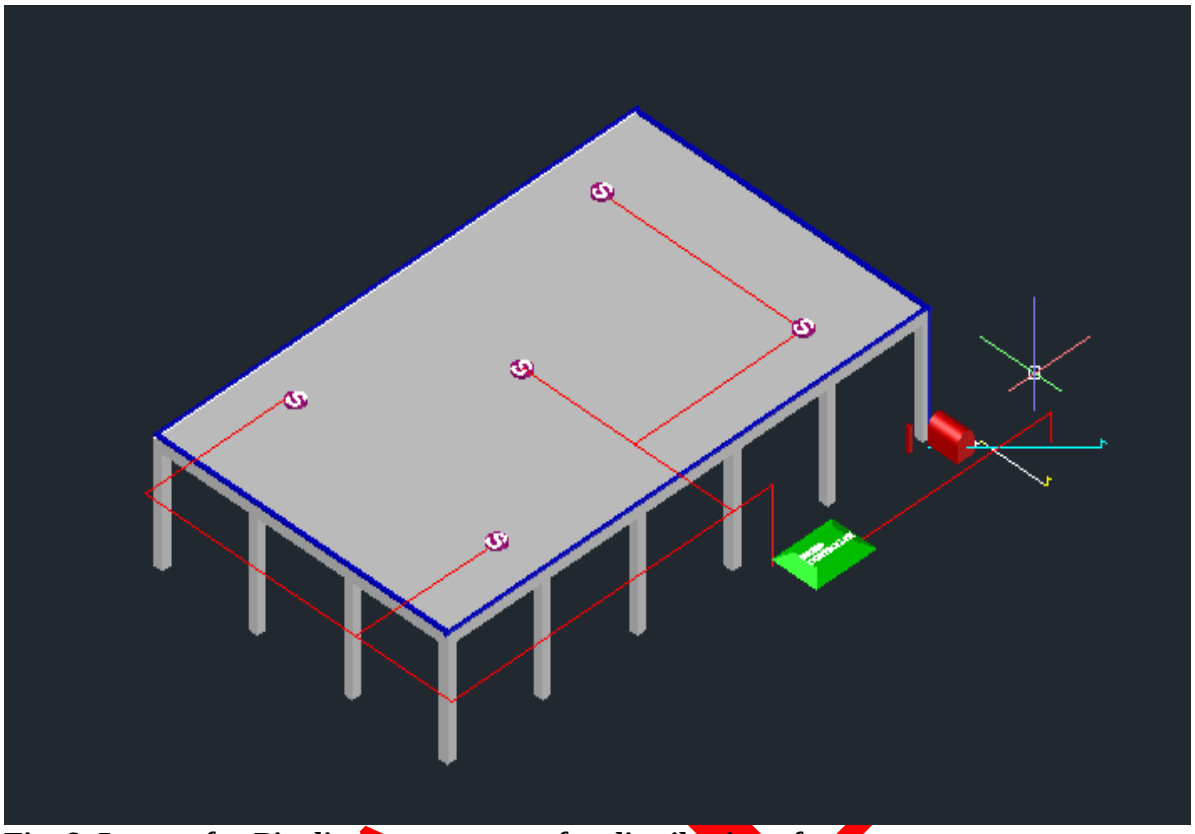


Fig. 6: Layout for Pipeline arrangement for distribution of water

CONCLUSION:

Curing in places like over bridge, mass construction, skyscrapers, where it is done with more vulnerabilities, this technology will be a solution to ease the work done.

- Cost effective: The daily wages to a labour for curing is around 500rs, and for 28 days it will cost more than 10000rs. With this technology the money spent on curing can be reduced effectively.
- Reliable: As the process is done almost by automated electronics, Nomonitoring or human interference is required, so this is much more reliable than conventional method.
- Efficiency: The quantity of water required for curing is calculated from the test done above, with the help of those results, Water is sprayed in sufficient quantity for the concrete. Hence making it a water conserving technology.

REFERENCES:

[1.]Decagon Devices "*List of peer-reviewed publications using Decagon soil moisture sensors*". Retrieved: 20 July 2015.

[2.] Arduino Genuine, *https://www.arduino.cc/*

[3.]IS: 516-1959 – Methods of tests for strength of concrete.