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# Smart System for Monuments and Bridges using IoT

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**ABSTRACT**: The opportunities and the challenges of applying IoT to culture preservation and revitalization of historical buildings, monuments and bridges have been focused. The aim of "Smart System for Monuments and Bridges using IoT" is to improve preservation, revitalization, livability, and sustainability. Different from the focus of smart city based on the needs of living in the present this system have been developed. The objective of proposed system is preservation of historical monuments. As blessed with the good and outstanding history, it is our duty to preserve them as long as we can so the next generation can also have the proofs and evidences of it.

**KEYWORDS**: IoT,ESP8266 Development kit, Pressure Sensor, Vibration Sensor, Temperature Sensor.

## I. INTRODUCTION

IoT describes a world where anything can be connected and communicated in an intelligent fashion. In simple words it is a network of different physical objects that can interact with each other to share information and take action. This term was first proposed by Kevin Ashton in year 1999 and this concept became popular at auto-ID center, MIT[1]. This has been adopted in the Padova Smart City project, which gives proof of deployment of an IoT island in the city of Padova, Italy, performed in collaboration with the city municipality[2]. This concept of IoT not only helps to create and implement new things but also it is used to preserve the past i.e. preservation of cultural heritage and historical monuments. Smart city concept not only means the creation of new but also the conservation of monuments, forts, gates and bridges.

Proper maintenance of the historical buildings and bridges requires the continuous monitoring of the actual conditions of each building and bridges and identification of the areas that are most subject to the impact of external agents. The IoT provides a distributed database of building structural integrity measurements, collected by suitable sensors located in the buildings and on the bridges, such as vibration and pressure sensors to monitor the building and bridge stress, and temperature and humidity sensors to have a complete characterization of the environmental conditions. This database reduces the need for expensive periodic structural testing by human operators andallows targeted and proactive maintenance and restoration actions. It is possible to combine vibration and pressure readings in order to better study and understand the impact of light earthquakes on historical buildings and bridges. This database is made publicly accessible in order to make the citizens aware of the care taken in preserving the historical heritage and bridges.

## II. RELATED WORK

The estimation of mechanical properties of concrete is carried out by several methods which include destructive and non-destructive methods. J. Helal et al.describes the most common non-destructive testing (NDT) methods of concrete structures. NDT of concrete was found to be gaining increasing acceptance as a means of evaluating the strength, uniformity, durability and other properties of existing concrete structures. It relies on comparing testedparameters with established correlations. Observed relationships provided by manufacturers were found to be often provided unsatisfactory results[3].Nazarian et al. describes non-destructive tests which are widely applied to study mechanical properties and integrity of concrete[4].The crushing of the samples is the usual destructive test to determine the concrete strength. The rebound hammer test and the ultrasonic device are used in the field of non-destructive tests to determine respectively the compression strength and the ultrasonic pulse velocity (UPV) in the concrete[5].HisaoEmotoet al.describes methods for physically checking and predicting the remaining life of an aged

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RC-T girder bridge and for verification based on field tests using either visual inspection data or concrete core test results[6].

## III. PROPOSED SYSTEM

The proposed system is used for real time data analysis of a few physical variables which is divided among the various sensors. Such a device would be extremely beneficial to keep a check on parameters where constant monitoring is required. It includes various blocks such as ESP8266 Wi-Fi development kit, router and sensor equipment. Various sensors are interfaced with ESP8266 Wi-Fi development kit to detect various parameters such as vibration, pressure and temperature.

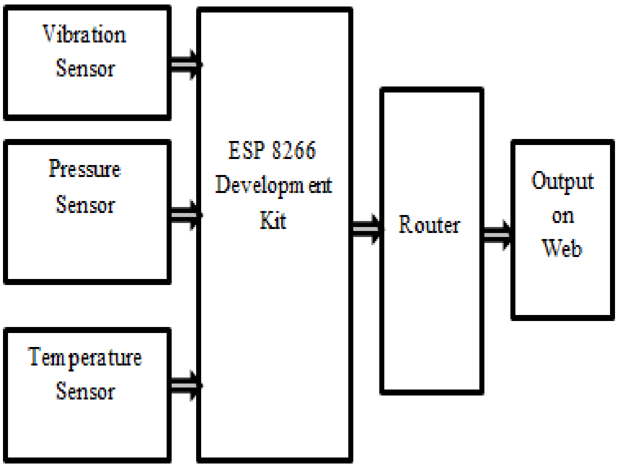


Fig.1. Block Diagram

The vibration sensor which is SW-18020p series sensor isa spring type, no directional vibration sensor trigger switch, which can be triggered at any angle.Sensor acts as an open circuit when it is static or off state, when external force to touch occurs and corresponding vibration, or movement speed achieve adequate (partial) centrifugal force, conductive pick feet will produce instant conductivity is instant ON-state, when external force disappear, switch back to open circuit OFF-state. The next sensor is BMP180 a new digital barometric pressure sensor, with a very high performance, which enables applications in advanced mobile devices, such as smart phones, tablet PCs and sports devices. It follows the BMP085 and brings many improvements, like the smaller size and the expansion of digital interfaces.The ESP 8266 development kit offers a complete and self-contained Wi-Fi networking solution. It is a 80Mhz 32Bit Tensilica L106 CPU which integrates GPIO, PWM, I2C and 10-bit ADC all in one board. Operating voltage of development kit is 3.0V ~ 3.6V whereas operating current average value is 80mA. It operates at temperature range between -40°C ~ 125°C. The ESP8266 module is an extremely cost effective board with a huge and ever growing community.Wi-Fi module gets connected to the router and the output is displayed on ThingSpeak which is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications and a social network of things with real time status updates, plotting real time graphs and data of the sensors.

## IV. RESULTS

To assemble this environment, software used is Arduino IDE. The result is observed on serial monitorwho has been connected to the cloud through a possibly wireless internet connection to upload or receive data. Objects connected are typically augmented with different sensors such as pressure, temperature and vibration.For the purpose of connecting an object to the IoT, the ThingSpeak API is used which givesthe current updates of the bridges, monuments and buildings to an individual.During the experimental setup values from various sensors for different dates have been

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taken. Figure.2 illustrates real time graph of various sensors for four different dates 20thfeb, 27thfeb, 6th march and 13thmarch. In the figure shown below it is displayed that pressure readings are observed on different days. On 20thfeb 94750Pa pressure was observed which was high as compared to the other readings of pressure. It slightly declined thereafter. On 27thfeb it was 94500Pa and on 6thof march it declined upto 94240Pa which is the lowest reading taken. On 13thmarch it slightly increased to 94622Pa.

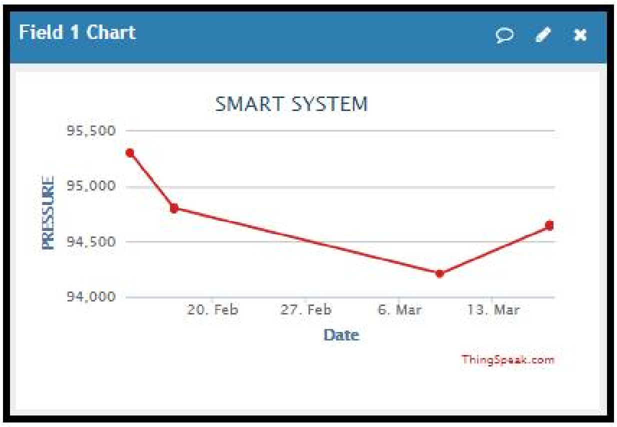


Fig.2. Field Charts for Pressure

These are the readings of temperature sensor observed simultaneously with the pressure sensor. Temperature observed on 20thfeb was 33.12ºC it went on varrying on different dates. On 27thfeb it was 31.84ºC whereas on 6th march it was 31.20ºC and on 13thMarch it was 32.4ºC.

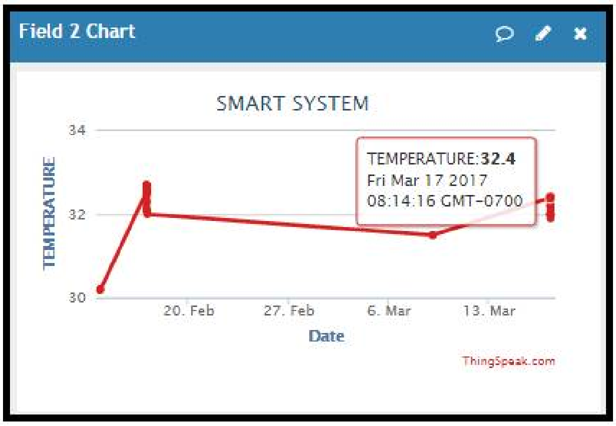


Fig.3. Field Charts for Temperature

Very fluctuating readings were observed with the vibration sensor. Before 20thfeb vibrations were above 15 and on 20thfeb it was 9. And it remained near to 9 till 6thof march. After 6thmarch it increased suddenly upto 17. Between 6thof march to 13th of march it decreased suddenly to 9 and again it increased 17 after 13thof march. From the obtained values it is observed that for each date the values obtained are different for pressure, temperature and vibration sensor.

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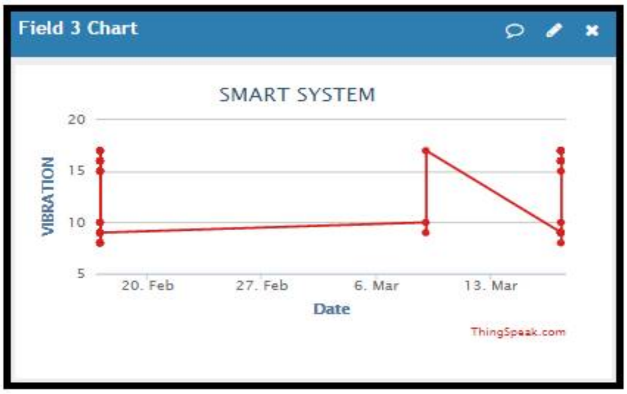


Fig.4. Field Charts for Vibration

## V. CONCLUSION AND FUTURE WORK

The proposed system overcomes all other system because of its low cost and high performance quality. Such a system would be extremely beneficial to keep a check on parameters where constant real time monitoring is required.Unlike other system this gives the current updates of the bridges, monuments and buildings to an individual at remote places. It can also be used in developments of smart cities to preserve smart structures. Also, this system analyzes the solution for the implementation of the system which can save lives and preserve history.

## REFERENCES

1. FriedemannMattern and Christian Floerkemeier, “From the Internet of Computers to the Internet of Things”.
2. Andrea Zanella, Nicola Bui, Angelo Castellani., “Internet of Things for Smart Cities ”, IEEE, Vol.1, Issue 1, 2014.
3. J. Helal, M. Sofi, P. Mendis., “Non-Destructive Testing of Concrete: A Review of Methods”,Electronic Journal of Structural Engineering 14(1), 2015.
4. JedidiMalek, MachtaKaouther, “Destructive and Non-destructive Testing of Concrete Structures”, Jordan Journal of Civil Engineering, Vol.8,Issue 4, 2014.
5. Nazarian, S., Baker, M., and Crain,K., “Assessing quality of concrete with wave propagation techniques”, Materials Journal,Vol.94, Issue 4, pp. 296-305, 1997.
6. HisaoEmoto, Jun Takahashi and Ayaho Miyamoto, “Remaining Life Prediction & Verification of an Aged Bridge based on Field Inspections”, International Conference on Sustainable Construction Materials and Technology, pp. 119-132,2012.
7. RatnaWidyawatia, Jun Takahashib, HisaoEmotoc, AyahoMiyamotoc, “Remaining life prediction of an aged bridge based on concrete core test’’, International Conference on Sustainable Civil Engineering Structures and Construction Materials, pp. 88 – 99, 2014
8. L. Atzori, A. Iera, and G. Morabito,“The internet of things: A survey,” Comput. Netw., vol. 54,Issue 15, pp. 2787–280, 2010.
9. J. P. Lynch and J. L. Kenneth, “A summary review of wireless sensors and sensor networks for structural health monitoring”, Shock and Vibration Digest, Vol.38,Issue 2, pp. 91–130, 2006.
10. Neil Kolban, “Kolbanbook of ESP8266”, September, 2015.
11. Antonio J. Jara, Yunchuan Sun T, Houbing Song, RongfangBie T, Dominique Genooud, YannBocchi, “Internet of Things for Cultural Heritage of Smart Cities and Smart Regions”, 29th International Conference on Advanced Information Networking and Applications Workshops, pp. 668-675 ,2015.
12. Athena Karumbaya, GowriSatheesh,“IoT Empowered Real Time Environment Monitoring System”, International Journal of Computer Applications, Vol.129, Issue 5, 2015.