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Research Article

WIRELESS SENSORS BASED FITNESS TRACKING SYSTEM FOR CIVIL STRUCTURES

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Abstract

This project discusses approximately, a wireless sensor community turned into advanced for structural health monitoring(SHM) to effectively hit upon, discover, and assess damage produced by way of environmental corrosion. Structural reaction displays the structural circumstance in addition to the excitation pressure. Structural fitness monitoring (SHM) is an energetic location of studies devoted to systems which can independently and proactively investigate the structural integrity of bridges, buildings. Latest technological advances promise the eventual potential to coverage a large civil structure with low-value wireless sensors that could constantly monitor a constructing's structural fitness. The concept struck into thoughts that a SHM gadget must be applied so that it may display structure using extraordinary floor,

I. Introduction

Civil structures are huge-scale structures that are required to withstand for long time and nature can impose upon them. Protection is a dominant issue that desires to be considered throughout the layout process of these multifaceted structural systems. This paper places ahead a powerful, feasible and dependable wireless sensor machine based totally on Blue term, that may guide tracking structural fitness consisting of buildings, bridges, roads. Wireless sensor network is available which can help structural owners and facility managers to make sure the safety of their structures. Visible inspections are broadly used to look into systems for outward symptoms of misery. traditional centralized SHM algorithms evolved by civil engineers can gain the highest harm detection fine since they've the uncooked data from all the sensor nodes. However, directly imposing these algorithms in a standard WSN is impractical thinking about the large quantity of records transmissions and huge computations required. Correspondingly, many SHM algorithms have been tailor - made for WSNs to emerge as dispensed and less complicated. Permanent monitoring systems also can be employed to continuously screen the reaction of civil systems to outside loads.

the availability of world structural reaction information from permanent monitoring systems has fuelled the boom of the sphere of structural health mounting sensors, those systems can monitoring. One shortcoming of such acquire diverse parameters of the systems lie of their dependence on structure. Wi-Fi module had been used to track the values accurately. This observe introduces exclusive tactics of SHM to screen and degree the vibration, stress, moisture and temperature of the constructing. Keywords: Structural health monitoring(SHM), Wireless sensor Networks(WSN), Wi-Fi module tremendous lengths of coaxial wires for the switch of sensor measurements, consequently using up their installation and preservation fees. constructed the use of commercially available parts, and integrated right into a complete wireless sensor. The fusion arithmetic of the temperature and acceleration is embedded inside the wireless shrewd sensor in order that the measured acceleration values are more correct. Measures are adopted to reduce the electricity consumption, which is an essential trouble for a wireless sensor. The hardware and software structure of the tracking gadget are the wireless sensor system achieves the anticipated impact with the aid of contrast with the wired monitor ing gadget. For the purpose of structural fitness monitoring for civil engineering systems, a wireless clever sensor is designed to reveal the temperature and acceleration of a structure. It introduces the definition of SHM in conjunction with the concept of WSNs. on the quit structural heath tracking might be beneficial in detecting all of the necessary damage detection, to calculate the life of building and to head for green algorithms. wireless sensor networks for structural fitness monitoring (SHM) software have attracted a great deal research hobby over the last few years because of their exceptional capacity to reveal and hold the safety of civil structures.

II. Literature Survey

2.1 Structural health monitoring using the semantic wireless

Industrialized countries have huge investments in civil infrastructure there is need for the proper structural audits for this Infrastructures. Structural health monitoring approach has come into action which is performed using Smart Sensors, Piezoelectric sensors and accelerometers are used for the environmental and some parameters of Structures, which results into detection of damages in structures. Data acquisition algorithms are used for transmission of data and calculate the overall statistics from the network, it requires less computational power. By this approach damage detection observation can be done from remote places. The parameters are measure vibration, temperature and moisture. It also identifies the stress, strain, vibration and load of a wall. This approach is mainly done using wireless sensor network. The network is simulated for the processing of data. The actual data is measure by the sensor which is

calibrated in units. At the end structural heath monitoring will be useful in detecting all the necessary damage detection, to calculate the life of building and to go for efficient algorithms.

2.2Health Monitoring of Civil Structures Using Wireless Sensor Networks

This chapter provides an overview of the challenges faced in the design of new techniques for enabling new decentralized solutions of large-scale wireless sensor networks (WSNs) in the structural health monitoring (SHM) domain. It introduces the definition of SHM along with the concept of WSNs. The chapter discusses the concepts of SHM and WSNs apart from one another. The chapter explains existent solutions employing WSNs in the context of SHM. It focuses on SHM techniques based on the use of accelerometers; but in further investigations, this classification can be expanded to works that use other kinds of sensing devices, for example, strain gauges, following the same logic of higher degrees of decentralization and in-network processing. The concept of generations of sensor networks for SHM was used for such classification. Each generation is presented by describing respective examples of works found in the current literature.

2.3 A Smart Gateway for Health Care System Using Wireless Sensor Network

In recent years, using wireless sensor networks (WSNs) for structural health monitoring (SHM) has attracted increasing attention. Traditional centralized SHM algorithms developed by civil engineers can achieve the highest damage detection quality since they have the raw data from all the sensor nodes. However, directly implementing these algorithms in a typical WSN is impractical considering the large amount of data transmissions and extensive computations required. Correspondingly, many SHM algorithms have been tailored for WSNs to become distributed and less complicated. However, the modified algorithms usually cannot achieve the same damage detection quality of the original centralized counterparts. In this paper, we select a classical SHM algorithm: The Eigen-system realization algorithm (ERA), and propose a distributed version for WSNs. In this approach, the required computations in the ERA are updated incrementally along a path constructed from the deployed sensor nodes. This distributed version is able to achieve the same quality of the original ERA using much smaller wireless transmissions and computations. The efficacy of the proposed approach is demonstrated through both simulation and experiment.

2.4 Structural health monitoring of river bridges using wireless sensor networks

For the purpose of structural health monitoring for civil engineering structures, a wireless intelligent sensor is designed to monitor the temperature and acceleration of a structure. Several modules are constructed using commercially available parts, and integrated into a complete wireless sensor. The fusion arithmetic of the temperature

and acceleration is embedded in the wireless intelligent sensor so that the measured acceleration values are more accurate. Measures are adopted to reduce the energy consumption, which is an important issue for a wireless sensor. Experimental results are given to show the feasibility of the designed wireless sensor.

2.5 Distributed Sensing for High Quality Structural Health Monitoring Using Wireless Sensor Networks

Wireless sensor networks for structural health monitoring (SHM) application have attracted much research interest over the last few years because of their great potential to monitor and maintain the safety of civil structures. This paper puts forward an effective, feasible and reliable wireless

sensor system based on ZigBee technology, which can support monitoring structural health such as buildings, bridges, roads. The hardware and software structure of the monitoring system are introduced first, and then the system performance under the multi-hop network topology and TPSN algorithm are analyzed, which is used for enhancing the precision of time synchronization. The experiment shows that the performance of the wireless sensor system achieves the expected effect by comparison with the wired monitoring system.

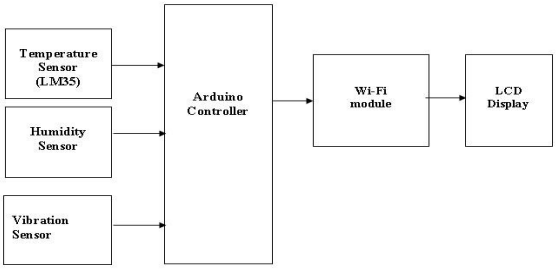

Fig:1 Block Diagram III. Proposed Structructural Health Monotoring.

Arduino Controller has the main leading device in Embedded systems and it can interface with any devices like sensors.

Features:

The Arduino Uno can be powered via the USB connection or with an external power supply. If we are using external power, then we can supply 6 to 20 volts. Arduino works on 5 volts.3.3 volts DC power supply.

The Clock speed of the Arduino is 16 MegaHz so it can perform a particular task faster than the other processor or controller. Most important feature of Arduino Uno is USB connectivity.

3.3 Vibration Sensor

A vibration sensor is an electromechanical tool that measures pulsation. those forces can be static, like the consistent pressure of gravity pulling at our feet, or they can be dynamic - caused by moving or vibrating the vibration sensor. there are numerous sorts of accelerometers developed and suggested in the literature.

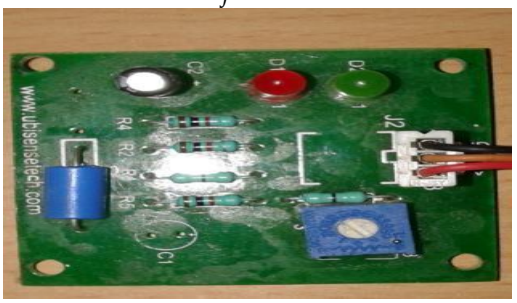

Fig 3.3Vibration sensor

3.4 Humidity Sensor

Humidity of the constructing may be measured with the aid of using HS220 sensor by means of mounting the sensor on the surface of the constructing. in this unique sensors are used like temperature sensors, humidity sensor &Arduino controller is also used. The Smarted humidity sensor is a terminal capacitor, which increases in fee as water molecules are absorbed into its lively polymer dielectric.

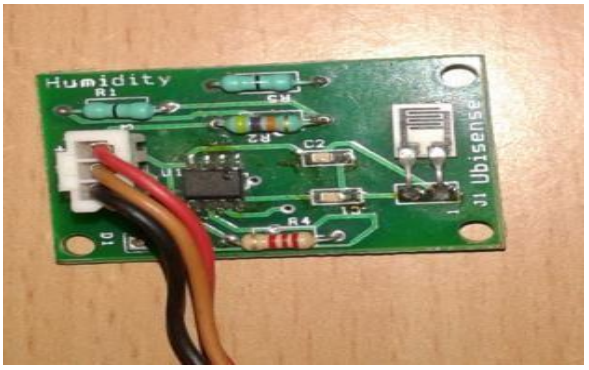

Fig 3.6Humidity sensor.

3.5 Temperature Sensor

A temperature sensor is a device, usually, a thermocouple or RTD, that gives for temperature dimension thru an electrical sign.

A thermocouple (T/C) is crafted from two numerous metals that generate electric voltage in direct share to changes in temperature.

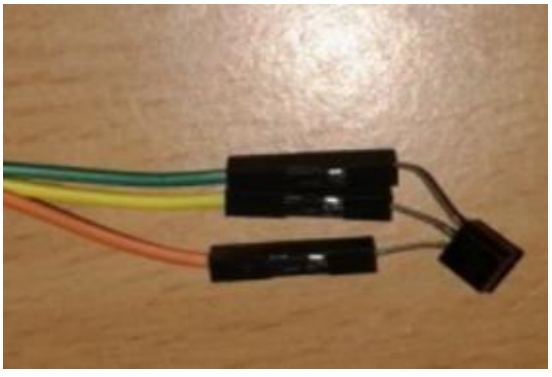

Fig 2.5: Temperature sensor.

3.6 WI-FI Module

It Supports 802.11b/g wireless standard and three network protocol. Wi-Fi module can act as a router and bridge mode. One antenna for the transmission mode. Support heartbeat signal and Wi-Fi connection indication and UART auto-frame function. 3.3Volts power supply. Max transmission distance: 280 m (undeveloped distance, 3dbi projection).

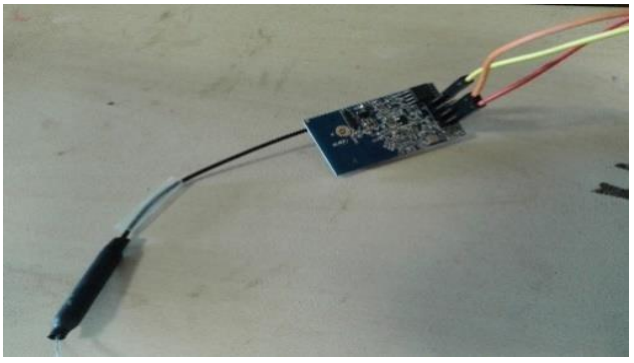

Fig3.6 Wi-Fi module

3.7. Challenges in SHM

- Selection of sensors to be used
- Location of sensors on the structure
- Determination of strength of the structure and Detection of level of damage.

3.8 Why SHM?

Damages like matrix cracking, delaminat io n, deboning or fibre breakage in composite structures are unavoidable during service life time due to impact or continual load, chemical corrosion and aging, change of ambient conditions, etc.

The following are the needs for SHM.

- To timely detect structural damage and take remedial actions
- Conventional visual inspection is time as well as cost ineffective
- SHM can facilitate monitoring of external loads, deflection and understanding structural behaviour.

3.9 Benefits of using WSN

Structural health monitoring itself is a replacement conception. The conservative methodology uses PC underwired to piezoelectric accelerometers. However, this method has drawbacks in that (1) wireless sensors are used because these are very easy to use (2) the instrumentality is expensive (3) Installation is very expensive due to wiring, and sensors (4).

It's maintenance is additionall expensive. Recent years have seen growing interest in SHM based on wireless sensor networks (WSNs) due to their low installation and maintenance expenses. WSNs allows a dense preparation of measure points on associate existing structure, facilitating correct and fault-tolerant damage identification techniques without installing a hard and fast infrastructure.

IV. Experimental Results

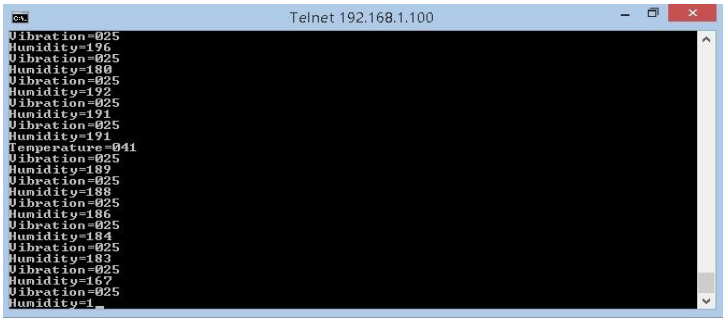

Fig:4.1 Experimental result for Temperature.

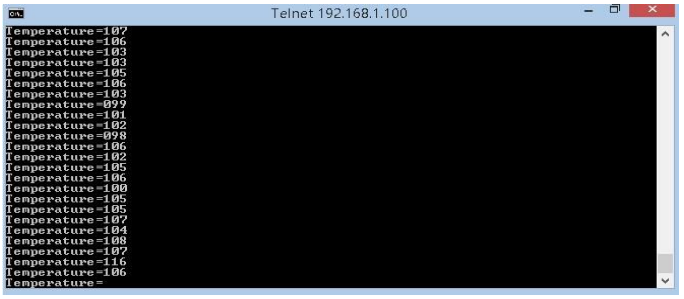

Fig:4.3 Experimental result for Humidity, Vibration.

V. Project Overview

This project discusses approximately, a wireless sensor community turned into advanced for structural health monitoring(SHM) to effectively hit upon, discover, and assess damage produced by way of environmental corrosion. Structural reaction displays the structural circumstance in addition to the excitation pressure. Structural fitness monitoring (SHM) is an energetic location of studies devoted to systems which can independently and proactively investigate the structural integrity of bridges, buildings. latest technological advances promise the eventual potential to coverage a large civil structure with low-value wireless sensors that could constantly monitor a constructing's structural fitness. The concept struck into thoughts that a SHM gadget must be applied so that it may display structure using extraordinary floor mounting sensors, those systems can acquire diverse parameters of the structure. In this paper we used the blue term application based on Bluetooth technology. This observe introduces exclusive tactics of SHM to screen and degree the acceleration, stress, moisture and temperature of the infrastructure.

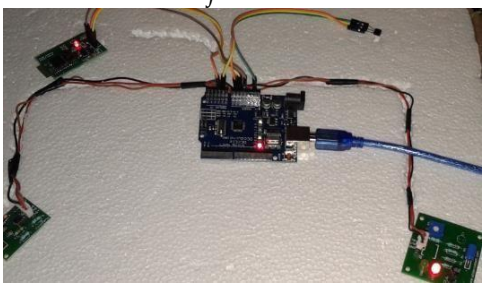

Fig:5.1StructuralHealthmonitoring prototype

VI. Conclusion

In this project we have developed a prototype of the structural health monitoring of a civil infrastructure. We have used different types of wireless sensors like Humidity, vibration and temperature. In this Wi-Fi module is used and it is small wireless technology.

his project could also be used as scouring of the bridges across the towns and cities.

In future this prototype could be extended in real time implementation of bridges and the huge infrastructures.

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