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Bridge Monitoring and Risk Analysis using IoT

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Abstract-

Bridge monitoring system is noteworthy to health identification of bridges. This report is planned and developed style for bridge monitoring. This project system uses wireless network on real time basis for bridge health monitoring purpose. during this detection of vibrations, displacement detection is done. Presently bridge examination is completed by manually anytime and in addition takes a great deal of your time to go looking out & sight any fault. It wants specialized or practiced man for examination of bridge. They have to observe the condition of bridge by visual examination utterly. Conventionally, a technician is responsible to sight and live vibration at intervals the sphere. Then implementing the correction methodology for any water level, barrier, and vibration of the bridge is hard. In addition the a great deal of attention required at the time of rainy season.Throughout this paper several experiments were conducted throughout a controlled setting and their results were compared with other ways. Our planned project analysis is focusing of implementation of system having sensors, technique that informs bridge condition to officers. throughout this technique the water level sensor, vibration sensor and supersonic sensor will unendingly check bridge health, if there is fault in these activity then alert message show on liquid crystal display screen and in addition sense the servo motor can get automatic shut the barrier on bridge. This advance technique is extraordinarily helpful to human and nation in addition.

Keywords: Vibration sensor, Water level detection, servo motor (auto barrier), Ultrasonic sensor.

Introduction

Bridges and flyovers are critical in many region being used over several decades. It is critical to have a system to monitor the health of these bridges and report when and where maintenance operations are needed. India has a large inventory of bridges including 1,20,000 with over 51,000 bridges as much as 100 years old which have outlived their lifespan.
Following are the reason behind the collapsing of bridge structures:
Earthquakes-
Cause damage to all structures. because of earthquakes dozens of buildings and bridges may collapse. Flood-

IT causes many risks including damage of bridges also it decreases the life of bridge.
Ineffective design-
Bridges with poor design could fail to hold enough weight or with stand natural conditions ,etc.

To avoid the accidents happens on bridge the monitoring system work very efficiently because it contains following Modern technologies.

A. Internet of Things

In the today's world Internet has become the most important thing in people's life in all organization. Here, billions of people around the world use Internet for sending and receiving emails and social networking applications of the system. Sharing vast amount of data and many other things in IoT is performed. Generally, the use of Internet is growing day by day and another big area is global platform for permitting the machines and smart objects to communicate and compute called Internet of things (IoT) in networking. The IoT is a technology where objects around us will be able to connect to each other in the system. Here, Internet will remain as a backbone of this new area of the system. The IoT will create a world where all the objects are connected to the Internet and

communicate with each other with minimum human intervention [1] to optimize use of public resources to increase the quality of services offered to people and minimize the operational costs of the services in the IoT of network method.

B. WSN

IoT exists at the next level then WSN. In different words, WSN is commonly a technology used inside AN IoT system. an oversized assortment of sensors, as during a mesh network, are often accustomed gather information and send information through a router to the web in an IoT system. it's conjointly necessary to notice that the term "wireless detector network" isn't nearly as encompassing as "the net of things." WSN consists of a network of solely wireless sensors. If the network was to incorporate a wired detector, it may now not be labeled a "wireless detector network." this is often in contrast to IoT. primarily any device that connects to the web are often thought-about an IoT device. AN "IoT system" will so be taken as a gaggle of the many IoT devices.

I. LITRATURE SURVEY

This paper presents Bridge safety monitoring system that monitors and analyzes in real time the conditions of a bridge and its surroundings as well as the waters levels, vibration of a bridge and alternative safety conditions.

In countries like India there's powerful concentrate on national infrastructure. New bridges area unit engineered every year and therefore the maintenance of these bridges is usually unheeded. This structures uses terribly advanced and excessive fee wired network and it in addition needed high repairs for fiber machine. therefore the primary objective of this task is to make an inexpensive bridge pursuit machine for developing international locations like India. This project aim to alter the system for choosing bridge pursuit devices. several bridges inside the India area unit obsolete or structurally deficient to securely increase the lifetime of those bridges, review would be important. Bridge engineers have several duties and it is impossible to expect one to grasp. Our device can sense the crack within the bridge and signal can be given to manipulate area at once to prevent cars [2].

Many of the bridges in cities engineered on the watercourse area unit subject to deterioration as their life is terminated however they're still in use. they're dangerous to bridge users. Due to heavy load of vehicles, high water level or pressure, serious rains these bridges could get collapse that successively results in disaster. So, these bridges need continuous watching. therefore we tend to area unit proposing a system that consists of a weight detector, water level purpose contact detector, Wi-Fi module, and Arduino microcontroller. this method detects the load of vehicles, water level, and pressure. If the water level, water pressure and vehicle load on the bridge cross its threshold value then it generates the alert through buzzer and auto barrier. If it's necessary, then the admin assign the task to the staff for maintenance [3].

As wireless smart sensor networks and geographical info systems (GIS) area unit evolving today, applications of remote watching in wide unfold geographical areas are getting cost-efficient and potential. Associate in Nursing example of such applications is that the structural health standing watching of route bridges that connect roads in each rural and concrete areas. several of those bridges area unit subject to deterioration due to external and internal factors. Online, real-time structural health monitering could be a capable complimentary tool to facilitate fast field review. Bridge maintenance and infrastructure managers will simply use this application to safeguard the performance and safety of those important structures. This paper presents Associate in Nursing autonomous wireless detector network system to observe structural health in highways bridges. The planned system consists of a wireless knowledge Acquisition Unit (DAQ), a mobile public network, structural health knowledge analysis, a management middleware, a GIS and graphical computer program module. The sensors within the DAQ gather the bridge health signs and transmit them promptly via the general public mobile networks to the management and analysis middleware for additional process. supported the national bridge inventory rating scale, Associate in Nursing early warning formal logic primarily based engine is developed to method the standing of a given bridge and alert the involved operators relating to any abnormality. what is more, Associate in Nursing interactive Google map is employed to indicate the standing of every bridge beside its actual location. A image was in-built the laboratory to validate the planned system. Analysis of testing results and comparisons with existing watching systems are mentioned. Operators will access the bridge period knowledge through itinerant. The system is price effective and user friendly [4].

Bridges could get collapsed or tipped due to flooding or some concrete problem, natural calamities. therefore there's a requirement to design a system which can unceasingly monitor condition of bridges. it's helpful for public safety and reduction in human losses. Such system can facilitate in disaster management and recovery. IoT based bridge safety watching system is developed victimization the WSN Technology. this method consists of watching devices put in within the bridge surroundings, communication devices connecting the bridge watching devices and therefore the cloud primarily based server, a dynamic info that stores bridge condition knowledge, cloud primarily based server calculates and analyzes knowledge transmitted from the watching devices. this method will monitor and analyze in real time the condition of a bridge and its surroundings, as well as the water levels and alternative safety conditions. This paper presents a comprehensive survey of SHM victimization WSNs outlining and formula like harm detection and localization, network style challenges and future analysis direction [5].

II. PROPOSED PROBLEM STATEMENT

In this project a plan of bridge monitoring system using IoT is projected for short distance (among sensors within the bridge) Wi-fi is used as wireless network, and it's used for long distance (between the bridge and therefore the management center) data communication. This technology are often known as MBM (Monitoring based mostly Maintenance) that allows the bridge maintenance engineers monitor the condition of the bridge in real time. The sensors

put in on varied elements of the bridge monitors the bend, water level etc. At associatey purpose of your time if any of those parameters cross their threshold price the communication system informs the management center giving an alarm and notification for taking precautionary measures.

III. PROJECT OBJECTIVES

The main objective of our project is to :

- Monitor the water level within the bridge.
- Indicates once there area unit earthquakes, cracks and bending within the bridges.
- To give safety for bridges.
- To avoid accidents just in case of serious rain.
- To improve the bridge potency.

V. PROPOSED ARCHITECTURE

The planned system is applying the idea internet of things (IoT) in that the sensors are installed on varied components of the bridge as shown within the Fig.1 design with connected device nodes , monitors the bend, water level etc. At associate purpose of your time if any of those parameters cross their threshold price the communication system informs the management center giving an alarm for taking precautional measures. The whole parameters of the bridge area unit taken by a controller and sent to a different module that is found during a short distance. Here the communication established is mistreatment Wi-fi that uses wireless Transmitter and Receiver electronic equipment. The receiver module takes the parameters from the transmitter and sends a message with all the parameters to a info center. The communication established between the intermediate module and also the info Centre is mistreatment Wi-Fi technology. The sensory inputs area unit method to represent the condition of the bridge.

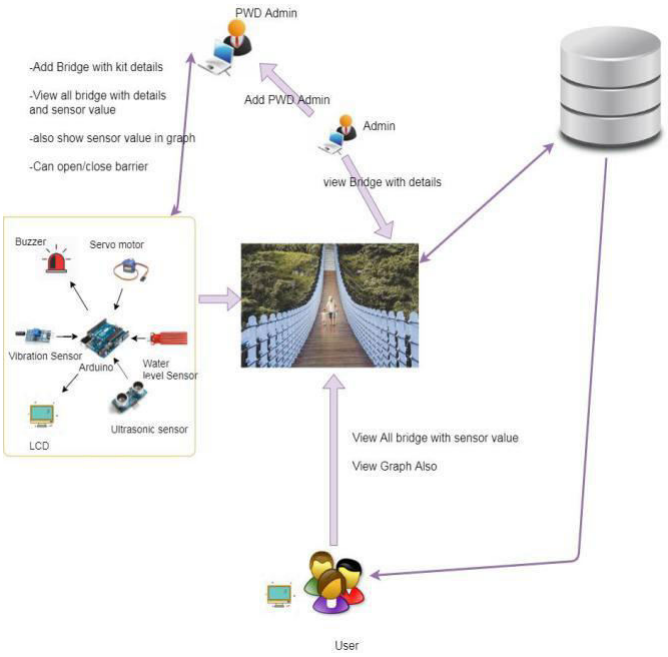

Fig. 1: Architecture with connected sensor nodes

The data reading from varied nodes is collected and hold on on the info; an area database to store the readings, and generate graph is used for accessing information. this method will alter 24x7 bridge safety management also as prompt and applicable responses to emergency incidents. Bridge observance and alert generation system victimisation IoT , to alert victimisation buzzer and auto-barrier once there ar signs of collapsing the bridge. All the collected environmental information send to the server within the system is use risk analysis.

IV. DATA SYNCHRONIZATION ALGORITHM

The data synchronization is nothing but the process of establishing consistency between data from sender/source to the receiver/target data and vice-versa and the continue organization of the data over time.

The problem of data synchronization exists in many application scenarios, such as distributed system, cloud computing and social network. Comparing with these fields, the data synchronization in IoT system has such characteristics:

Gateway is the source endpoint of synchronization, and platform is the target endpoint.

The device/node should have a Unique Identification (UID) in the gateway. Platform could exclusively determine a device in the IoT system by gateway and device unique identification.

- Declare the sensor values as input.
- Declare servo motor as output.
- If the sensors value reaches the maximum threshold then there is chances of risk and Immediately the gate gets close and parallelly the notification send to central office.
- After the above condition, current status of bridge will display on LCD i.e safe or unsafe.

With the reference to above algorithm, the risk can be reduce and appropriate notification will sent.

V. PROPOSED METHODOLOGY

The bridge monitoring system hardware as well as software. hardware part conations sensors and the controlling device where software is nothing but the interface for different functionality.

The software sytem consist of two logins i.e Super PWD Admin(Public Work Department) and PWD Admin(region wise)

Super PWD admin

- Super PWD admin manage all the bridges of the city.
- Super PWD admin can Add and remove sub pwd admin.

PWD admin

- PWD admin can view the bridge condition in graphical view.
- PWD admin can manually Open or Close the barrier.

User (citizen)

- User can check the bridge status i.e. Safe or unsafe

Below figure shows the login of Super PWD Admin:
Admin can log on to the system by his/her credential. Admin account is the most powerful account who is responsible for managing all the activities.

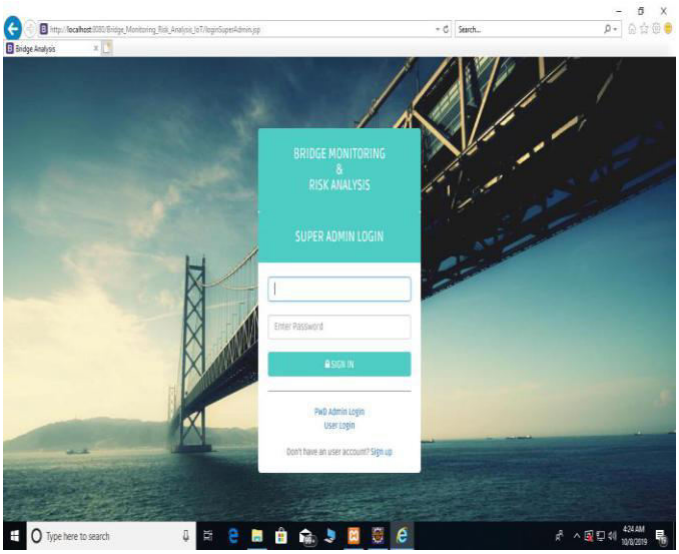

Fig 2: Web application
Super PWD Admin login

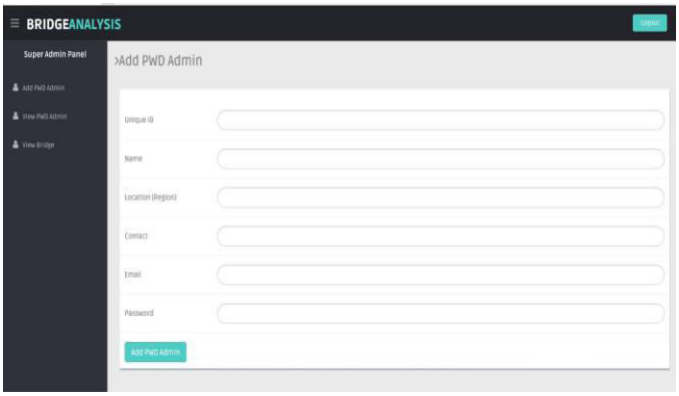

Fig 3: Super PWD Admin login
Add PWD Admin(region wise)

The Super PWD Admin can add the PWD Admin according to the region by adding their information and Super Admin provides the credentials to them for further works.
After adding PWD Admin into the system. PWD Admin able to log on to the system, after log on into the system PWD admin can add the bridge based on bridge id which are lies in his/her region.

PWD admin can also monitor the hardware when there is any emergency such as construction by using switch.

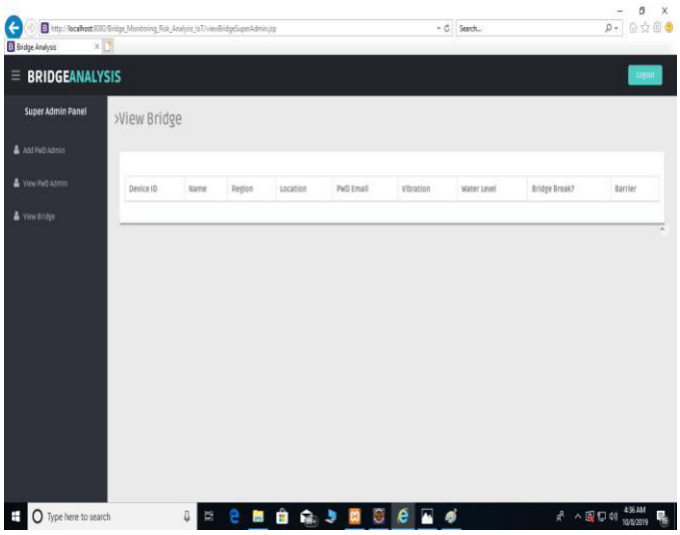

Fig 4: Bridge details

Super PWD Admin can view all the bridge details and can also view the condition of bridge in graphical format.

VI. CONCLUSION

This study is meant to develop a bridge safety monitoring system that integrates the technologies of IoT, and monitoring sensors. this method is exclusive in its ability to observe the bridge setting, transmit the environmental information through wireless communication(Wi-Fi) and send alerts to the bridge management workers in real time from prompt reactions. this method will alter 24x7 bridge safety management yet as prompt and applicable responses to emergency incidents. Bridge monitoring and alert generation system victimisation IoT , to alert victimisation buzzer and auto-barrier once there ar signs of collapsing the bridge. All the collected environmental information send to the server within the system is use for large information analysis or follow-up analysis. The system develop during this study is preliminary exploration. Future analysis is required to enhance the system by analyzing information collected by the system and developing additional advance computing models and operational practices for the system .This system can to scale back huge disaster in future. this method will save lives of might peoples.

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