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Microcontroller based Railway Bridge Monitoring

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Abstract: ***Railway Bridge monitoring in developing countries like India there is strong focus on national infrastructure. The maintenance of these bridges is many times overlooked. Furthermore, the present frameworks utilize muddled and surprising expense wired system and high upkeep optical fiber framework. Observing and investigating strength of scaffolds overwhelming hardware is critical for wellbeing, efficient, operational, making earlier defensive measures, and fix and support perspective. As of late there is developing interest for such bigger structures which thusly make individuals center more around security. By utilizing Microelectromechanical Systems (MEMS) Accelerometer we can perform Structural Health Monitoring by concentrate the dynamic reaction through proportion of surrounding vibrations and solid movement of such structures. Real-time location is tracked if the fault occurred.***

Index Terms: Railway bridge monitor, Track investigation, GPS.

I. INTRODUCTION

In India the greater part of the business transport is being completed by the railroad arrange and along these lines as any issue happened amid transportation straightforwardly influences the economy and rail route task effectiveness, additionally devour parcels if time for re-creation. In the course of the most recent couple of decades, Rail Transportation has turned out to be a standout amongst the best methods for transporting travelers and products, so the wellbeing and dependability is exceedingly considered. In railroad framework, the whenever the extension track can be harmed because of climate conditions, surges,seismic tremors, typhoon and so on. Along these lines intermittent observing of the foundation is to guarantee the security of railroads. The current track reviewing frameworks have a few confinements. It requires greater investment and it is less precise. The proposed framework quickly advises the splits in the track and illuminates to the railroad specialist and thus can decrease the train mishaps because of break extension over the five years from 2009. The successful administration of rail framework will be crucial to this advancement, updating, and development, especially whenever combined with a move to insightful foundation. A key piece of the administration will be condition observing. Condition checking distinguishes and recognizes crumbling in structures and framework before the decay causes a disappointment or averts rail tasks. In basic condition observing, sensors screen the state of a structure or apparatus. In the event that the sensor readings achieve a foreordained limit or blame condition, an alert is actuated.

II. LITRATURE SURVEY

The provoke identification of the conditions in rails that may prompt split or rather a break presently assumes a basic job in the support of rails around the world. With the entry of amazing advanced flag processors, picture handling methods have been sought to define answers for the issue of railroad break recognition. Notwithstanding the way that these strategies gives great precision, it utilizes procedures like picture division, morphology and edge discovery all of which take a ton of handling power and an extraordinary measure of time causing the robot speed moderate and in this way awkward. The comprehension of these instruments is always enhancing and to ensure the sheltered activity of rail traffic nondestructive investigation methods are utilized to recognize harms on rails. Presently a-days rails are presented to a consistent expanding exceptionally thick by and large traffic with substantial burdens and fast trains. Non-ruinous testing is one a player in the capacity of value control and is correlative to other since a long time ago settled techniques. By definition non-dangerous testing is the trying of materials, surface or inner blemishes or metallurgical condition without meddling in any capacity with the honesty of the material or its reasonableness for administration. As such non-dangerous testing isn't only technique for dismissing substandard material. It is additionally a confirmation that the as far as anyone knows great is great. The advancement of a scope of corresponding NDT (Non-Destructive Testing) systems has brought about various instruments for us to browse, for example, acoustic, emanations or ultrasonic strategies, attractive field techniques, radiography, whirlpool current procedures, warm field techniques, fiber optic sensors of different sorts. Among the review techniques used to guarantee rail honesty, the normal ones are visual investigation, ultrasonic assessment and whirlpool current examination. Visual assessment is the most established of the considerable number of techniques. Segments are examined outwardly, some of the time with a guide of low or high power focal points, fiber extensions, cameras and video gear, to decide surface condition. Nonetheless, in the Indian situation we find that the visual type of examination is broadly utilized however it

creates the poorest aftereffects of the considerable number of strategies. It is presently winding up generally acknowledged that even surface breaking frequently can't be seen with the stripped eyes. Accordingly this technique can be expensive, tedious and ineffectual for huge and complex auxiliary frameworks, for example, the rail track. Ultrasonic assessment [4, 5 and 6] is common place in rail industry in many foreign countries. It is generally surely knew strategy and was believed to be the best answer for split discovery. Anyway ultrasonic can just examine the center of material that is, the strategy can't check for surface and close surface splitting where a significant number of the shortcomings are found [3]. Microwave horn reception apparatus [4] method for break recognition was found to deliver extremely precise outcomes in lab based testing. Be that as it may, it requires range analyzers which are both expensive and furthermore can't be set on board a moving robot. Whirlpool current [7, 8 and 9] strategy is utilized to beat this restriction related with ultrasonic and microwave horn radio wire methods. They are successfully used to check for splits situated at the outside of the metals, for example, rails. Further MPI (Magnetic Particle Inspection) is additionally utilized in rail industry yet there are number of issues inborn with this procedure some of which are referenced underneath: Surface of the rail or segment should first be• cleaned all things considered, rust, etc. To get delicate readings, differentiate paint should first be• connected to the rail, trailed by the attractive molecule covering a similar examination should then be done in two unique ways at a moderate by and large speed. The issue innate in every one of these systems is that the expense acquired is high in the tracks. It likewise screen the basic wellbeing state of the lady of the hour alongside track give through remote sensor arrange hence expanding the security of extensions. Specialists gauge that the railroad business will get US$300 billion worth of w0orldwide speculation for improvement, updating, and

III. SYSTEM ARCHITECTURE

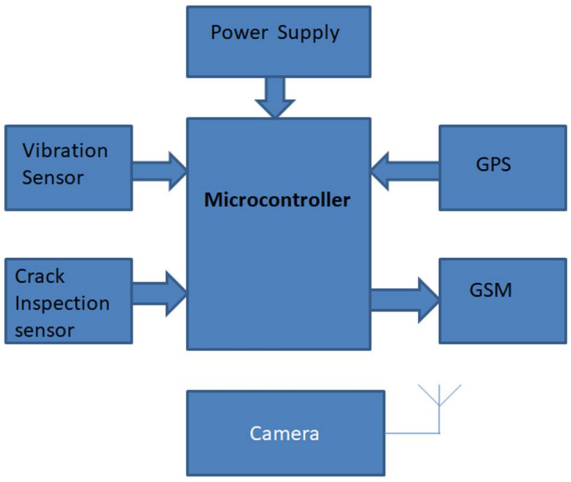

Figure: 1 Block diagram of Railway Bridge Monitoring System

Railway Bridge monitoring system (i.e. RBMS) is shown in figure.1.The RBMS consist of GSM module, GPS module, Vibration sensor and crack inspection sensor. AVR ATMEGA 328 microcontroller is used for the communication between various modules. The vibration sensor as well as crack inspection sensor is used to detect and trace the fault. The fault which is monitored by these sensors describes information to the microcontroller which is the heart of our system. The RBMS give alert short message through GSM to the control center. The control centre also gets location to check inspection of a bridge. The camera is also installed which can be seen remotely.

IV. THEORY OF TECHNIQUES

A. Arduino Uno

Arduino Uno is a microcontroller based board that comprises of ATmega328P microcontroller as its focal part. The ATMEGA 328P is an AVR group of microcontroller that has 14 computerized I/O pins (out of which 6 have PWM bolster), 6 (A5-A0) simple information pins, 2 pins (RX and TX) for sequential correspondence, 2 pins for (I/Oref. what's more, Aref) for ADC and 3 pins (3.3V , 5V and Vin) for supply voltage.

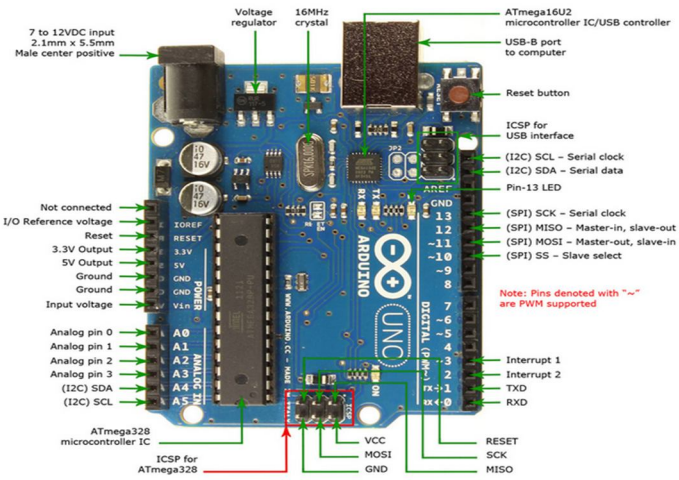

Figure: 2.Arduino UNO board [3]

The ATmega328P has an aggregate of 32 KB of glimmer memory, 2 KB of SRAM and 1 KB of EEPROM with a clock speed of 16MHz. Every I/O stick in ATMEGA 328P can get or give 20mA current. The greatest estimation of current which an I/O port can withstand is 40mA. An imaginative element that is given in Arduino Uno is it is reset by the product running on concerned PC as opposed to squeezing a reset catch physically before a transfer.

B. GSM Module

A GSM represents Global System for Mobile. In a GSM Module a GSM Modem is associated with a PCB and a different number of yields are taken from the module. There are various GSM modules accessible in the market out of which we have chosen SIM 900 for our venture. In SIM 900, the term 900 speaks to that the correspondence is upheld in 900MHz band as the majority of the versatile systems work in900MHz ISM band.

Figure: 3. GSM SIM 900 Module [5]

The GSM module can be associated with the Arduino in two distinctive ways. The principal strategy to interface GSM with Arduino is to utilize its sequential correspondence pins RX and TX. In this technique the RX of Arduino is associated with the TX of GSM, TX of Arduino is associated with the RX of GSM and the ground stick of Arduino to ground stick of GSM. The second strategy to build up association among Arduino and GSM is to utilize PWM any two PWM sticks rather than RX and TX. Yet, in both the cases the correspondence is sequential.

C. GPS Module

Figure:4. GPS Module

The Global Positioning System (GPS) is a satellite based route framework comprises of a system of 24 satellites situated into space. The framework gives basic data to military, common and business clients around the globe and which is unreservedly available to anybody with a GPS collector. GPS works in any climate conditions at anyplace on the planet. Ordinarily no membership expenses or framework charges to use GPS. A GPS beneficiary must be bolted on to the flag of in any event three satellites to evaluate 2D position (scope and longitude) and track development. With at least four satellites in sight, the recipient can decide the client's 3D position (scope, longitude and elevation). Once the vehicle position has been resolved, the GPS unit can decide other data like, speed, separation to goal, time and other. GPS collector is utilized for this examination work to identify the vehicle area and give data to mindful individual through GSM innovation.

D. Temperature Sensor

The DS18B20 Digital measuring device provides nine to 12-bit (configurable) temperature readings that indicate the temperature of the device. The DS18B20 communicates over a 1-Wire bus that by definition needs only 1 information line (and ground) for communication with a central microchip. In addition, the DS18B20 will derive power directly from the data line (“parasite power”), eliminating the need for an external power supply. This sensor has been included in many applications such as Thermostatic Controls, Industrial Systems, consumer Products, Thermometers, Thermally Sensitive Systems.Power provide vary is three.0V to 5.5V Measures temperatures from -55°C to +125°C. Fahrenheit equivalent is -67°F to +257°F±0.5°C accuracy from -10°C to +85°C Converts 12-bit temperature to digital word in 750 ms (max.)Can be steam-powered from knowledge line Alarm search command identifies and addresses devices whose temperature is outside of programmed limits (temperature alarm condition)

V. CONCLUSION

The Railway Bridge monitoring system using microcontroller and its sensor module which makes the system easy to monitor the fault. The system easily detects the position of a fault. The system can access the fault remotely and make the bridge health condition healthy.

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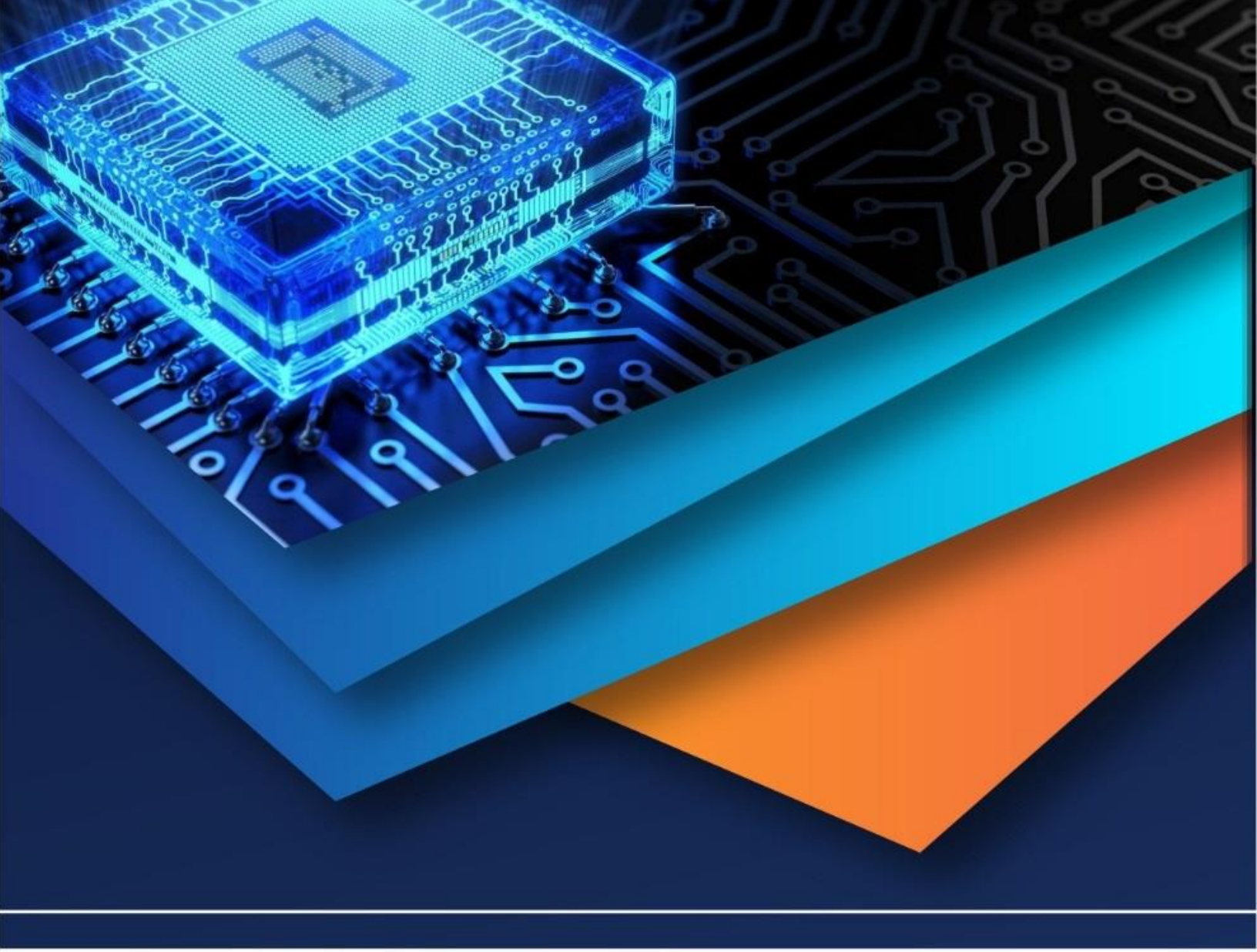

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