

MEMS Sensor based Railway Track Geometry Surveying System

Prof. Jamdar D.P.¹ Mr. Solapure O.R.² Mr. Devalekar R.R.³ Mr. Jagadale P.D.⁴

¹Assistant Professor ^{2,3,4}Student

^{1,2,3,4}Dr. Daulatrao Aher College of Engineering, Karad, Maharashtra, India.

Abstract— In this project, we introduced the MEMS based Railway track surveying system. MEMS are Micro Electro Mechanical switch are small integrated devices or system that combine electrical and mechanical components. the MEMS detect the surface irregularities and detects the shakes. In this project, the proposed track position detection system automatically detects the compared with the traditional detection techniques. The advantage of include less cost, less power consumption, and less analysis time. by this design system exact position of track tilt locate via GPS. To communicate the received information we make use of GSM modem. GSM model is collecting the latitude and longitude data and send to Railway authority board via SMS. **Key words:** MEMS Sensors, GSM Modem, GPS Modem, DC Motor

I. INTRODUCTION

Railway and roadway are the two means of transport over the land. The railway has advantage over the roadways that they can carry a large number of passengers and large and heavy loads to long distances. The existing track detection surveying system has some disadvantage it takes more time and it is less accurate. The proposed system immediately notifies the track tilt position (Left or Right side) and informs the railway authority and railway motorman to inform this route is not ok and stop the train.

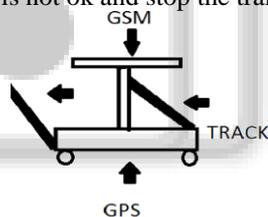


Fig. 1: System Design

II. PROPOSED SYSTEM

consist of multiple sensors such as Gps sensor is located track position and MEMS sensor which detects shakes. this system is mainly consists of GPS module which is used to find the exact position of the track and by using GSM module we will send the information to control section .

III. EXISTING SYSTEM

In general there exist three main categories of techniques currently used for damage identification and condition monitoring of railway tracks this include

- Visual inspections-is the primary technique used for identification and it is not effective technique. The leading cause of railway accidents is attributed to human error.
- Non -destructive testing (NDT) technologies.
- Based on Vibration.

IV. MOTIVATION

A vast majority of the work done in the field of crack detection uses the infrared sensing technique and It is a well understood technique so much so that it was initially thought to be the best solution to the problem of position of track detection, but later it was found to be prone to external disturbances and hence came to be considered inaccurate.

In month of August, a big accident of trains happened between Kamyani express and Janata express near Kudawa railway station in Madhya Pradesh. Due to this mishap 25 people have been killed.



Fig. 2: Kamyani and Janata express accident

V. OBJECTIVES

In this project are use of MEMS Sensor are use of position (Left and Right Side) Tilt position and this is very accurate position locate. GSM Module used to inform the railwat authority people via SMS to latitude and longitude data of track and stop to train in this route. DC Motors are use to drive the system design to track on slowly.

VI. BLOCK DIAGRAM

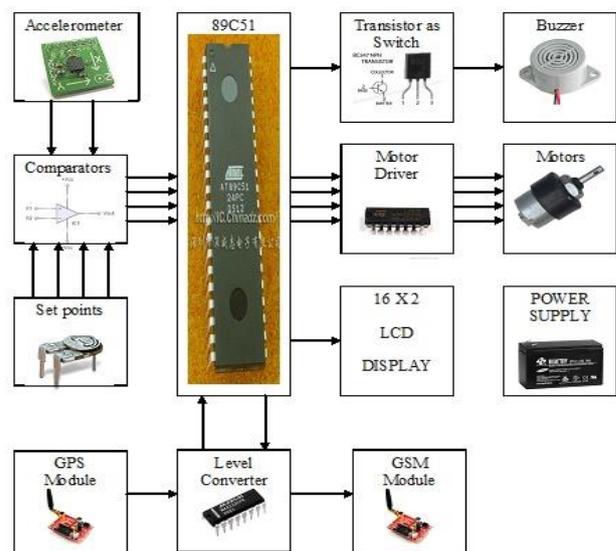


Fig. 3: Block diagram

VII. BLOCK DIAGRAM DESCRIPTION

Railway Track Geometry Surveying System has following blocks:

- 1) Microcontroller
- 2) MEMS sensor i.e. Accelerometer
- 3) Comparators with set points
- 4) Motor driver and Motors
- 5) Transistor as switch
- 6) Buzzer
- 7) Power supply
- 8) Level converter
- 9) GSM
- 10) GPS

VIII. WORKING

A. Microcontroller:

The microcontroller used in this system is LPC2148 microcontroller that is based on a 32/16 bit ARM7TDMI-S CPU with real time emulation make these devices very well suited for communication gateway and protocol converter, soft modems and low end imaging. This microcontroller is command to Dc motor and start of power supply and system model run.

B. MEMS Sensor i.e. Accelerometer:

Micro Electro Mechanical Switch (MEMS) are small integrated devices or systems that combine electrical and mechanical components. The MEMS detect the surface irregularities and detects the shakes.

C. Comparator and Set Point:

Output of accelerometer is given to op-amp as comparator. For 0 gravity output of accelerometer is 1.5V. For positive acceleration output increases above 1.5 volts and for negative acceleration output decreases below 1.5V.

Therefore the set point for comparator is above 1.5V and below 1.5V. And the output of this comparator is given to the microcontroller.

D. Motor Drivers and Motors:

A DC motors is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields nearly all types of DC motors have some internal mechanism.

E. Transistor as Switch:

When obstacle is detected we have to turn on the buzzer but output of micro-controller is not sufficient to drive the buzzer directly. Therefore to drive the buzzer we are using transistor as switch.

F. Buzzer:

This is output device. When there is problem in track geometry then Buzzer turns ON. Otherwise buzzer will be turned off.

G. Power Supply:

In our project, we require +12Vdc, and +5 Vdc supply. +5 volts is required for Micro-controller 89C51 board, sensors and signal conditioning etc.

+ 12 Volts are required for Buzzer, motor driver and motors. Our project is moving so we can't use 230Vac supply. Therefore we are using 12VDC battery.

H. Level Converter MAX 232:

RS-232 INTERFACE: For GSM modem which works on the RS-232 voltage levels, logic 1 varies from -3 to -15 volts and logic 0 from +3 to +15 volts. The microcontroller which works on TTL logic levels, logic 1 is +5 volts and logic 0 is 0 volts. Therefore, to interface the two we use a MAX 232 driver IC manufactured by Maxim.

I. GSM Modem:

The SIM 300 GSM Module has been used to achieve the SMS function.

The SIM 300 delivers GSM/GPRS900/1800/1900 Mhz performance for voice, SMS, data and Fax in a small form factors and with low power consumption.

J. GPS Modem:

SR-92 GPS receiver has been used as the GPS module. SR-92 is allow power, ultra-high performance, easy to use GPS smart antenna module based on SIRF'S third generation single chip. The 5 pin I/O interface is then connected to the main board with either connector or wire soldering.

The main feature of GPS module includes:

- High tracking sensitivity of -159dbm
- Hardware power saving control pin allowing power off GPS via GPIO.

IX. EXPECTED RESULT

In railway bridges, any time the bridge it's striking due to weather condition, floods, earthquake, cyclone, etc. Now days system have some limitations, if the bridge or track damaged, that information goes to railway authority people, they notifies and informs to the corresponding trains it will takes more time informing those information. So to avoid delays, our proposed system will immediately notifies and informs the current train comes on the track through wireless medium.

X. CONCLUSION

The proposed system automatically detects the position of track tilt in left or right side without any human intervention by using MEMS sensor and inform railway authority people via SMS. By this proposed system the exact location located and save many people lives.

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