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RAILWAY TRACK CRACK, GUAGE INSPECTION AND MAPPING SYSTEM

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***Abstract*— The extended advancement in the railroad range has realized a development in the prepare movement thickness over the world. This has realized the extension in the amount of accident including trains. This venture has a place with Embedded Field in Robotics area. The fundamental target of this is to recognize the breaks on railroad tracks. The essential objective is, dealing with the track condition for security of its structure and to stay away from mischances. To configuration split examination framework we utilize an ease highlight robot which depends on installed stage for finding the breaks. The equipment segments are microcontroller, Global System for Mobile communication modem, IR sensors, LCD Display and engines. A two wheel mechanical robot with sharp turnings is implicit this framework. The robot is moving autonomously in its specific direction. Controller Robot is interfaced with two sensors to identify the split field which is available. The robot is moving in its way if any break is available in its way and the comparing message can be sent. Here if the split is distinguished, then consequently the yield is shown on the LCD and the scope and longitude estimations of break on the track are send to the portable number by utilizing Global Positioning System and Global System for Mobile communication advances.**

***Index Terms*— ARM7, Global System for Mobile communication, Global Positioning System, IR sensors, Ultrasonic sensors.**

I. INTRODUCTION

In today's world, transport system is one of the essential and necessity systems because without transportation system we could not able to migrate from one place to another place also impossible to transport the products to production centers or markets. Throughout history, transportation is must therefore the proper maintenance is essential

The Indian railway network today has a track length of 113,617 kilometers (70,598 mi) over a route of 63,974 kilometer and 7,083 stations. It is the fourth largest Railway network in the world. Indian rail network is still on the growth trajectory trying to fuel the economic needs of our nation

Especially railway transportation is economically comfortable from poor people to rich people even though it would help to growing economy rapidly. Each and every day population is increasing in view of this we should take care of all the things which are basically needed to the human life. When issue occurred because of crashes or splits that causes in different loss of valuable human lives and furthermore property.

The factors that cause these rail accidents, recent statistics reveal that approximately 60% of all the rail accidents have derailments as their cause, of which about 90% are due to cracks on the rails either due to natural causes (like excessive expansion due to heat) or due to antisocial elements. Hence these cracks in railway lines have been a perennial problem which has to be addressed with utmost attention due to the frequency of rail usage in India. These cracks and other problems with the rails generally go unnoticed due to improper maintenance and the currently irregular and manual track line monitoring that is being carried out.

For this reason, we have used IR Obstacle sensor, which has only one module that has both transmitter and receiver and alignment will not be an issue.

The main objective of the project is to identify any crack or deformation on the railway track using this setup, which can be implemented in live by Railway authorities. The proposed setup would make the inspection and maintenance of railways tracks easier and help them to monitor efficiently by replacing the human inspection which is currently followed. The design of the vehicle and software related to it are very simple and can be easily adopted by the present system.

II. PROPOSED

The proposed Crack location conspire comprises of an IR-Photo diode get together that capacities as the rail break indicator. The standard required in break location is the idea of photograph diode. In the proposed plan, the IR will be joined to the other side of the rails and the photograph diode to the inverse side. Amid typical operation, when there are no Cracks, the IR light does not fall on the photograph diode and thus the photograph diode resistance is high. In this manner, when the IR light falls on the photograph diode, the resistance of the photograph diode gets lessened and the

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measure of decrease will be roughly relative to the force of the occurrence light. Along these lines, when light from the IR goes astray from its way because of the nearness of a Crack or a break, a sudden lessening in the resistance estimation of the photograph diode results. This adjustment in resistance shows the nearness of a break or some other comparative auxiliary deformity in the rails.

Keeping in mind the end goal to identify the present area of the gadget if there should be an occurrence of discovery of a split, a GPS collector whose capacity is to get the present scope and longitude information is utilized. To convey the got data, a PC has been used. The capacity of the PC being utilized is to transfer the present scope and longitude information to the applicable expert. The previously mentioned usefulness has been accomplished by interfacing the PC, GPS module and IR-Photo diode course of action with a microcontroller. DC engines drive the robot and transfers were utilized to control the engines.

Our Embedded framework utilizes an ARM7 32bit small scale controller. In this paper we utilize the LPC2148 is a microcontroller. Our Embedded framework incorporates distinctive sorts of sensors. In our venture we utilize ultrasonic sensors and IR sensors. Ultrasonic sensors are utilized to discover the separation between the tracks.

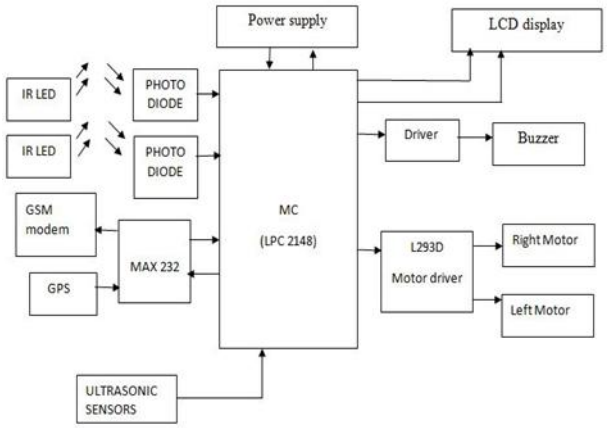

Fig. 1. Fundamental Block Diagram of the System

III. WORKING

The working of the Robot is clarified in underneath flowchart in Fig. 2.

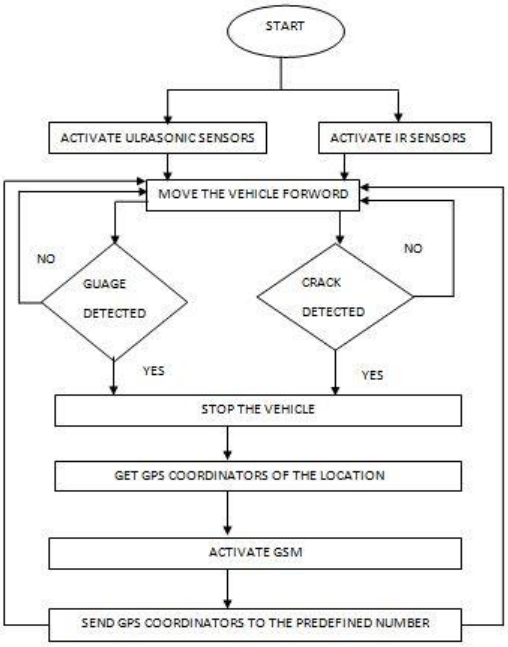

Fig. 2. Flowchart of the System.

As indicated by the Flowchart Initially, Both IR and Ultrasonic sensors are actuated and the vehicle begins proceeding onward the tracks. At whatever point there is a distinction in Gauge the Ultrasonic sensors will recognize the distinction and whenever there is a Crack in track the IR sensors will distinguish the Crack. The Location coordinates are obtained in both the cases by the GPS Module and the alert will be sent to the Mobile by the GSM Module.

IV. HARDWARE DESIGN

A. *Microcontroller Unit*

LPC2148 Microcontroller is utilized with ARM7 LPC2148 Pro Development Board. It is an independent board for the LPC2148 microcontroller. It has 12MHz precious stone for framework clock and 32KHz gem for RTC. It has control on reset circuit with MCP130T brownout observing chip and power decoupling capacitors. This board can be utilized for LPC2148 based non-specific advancement.

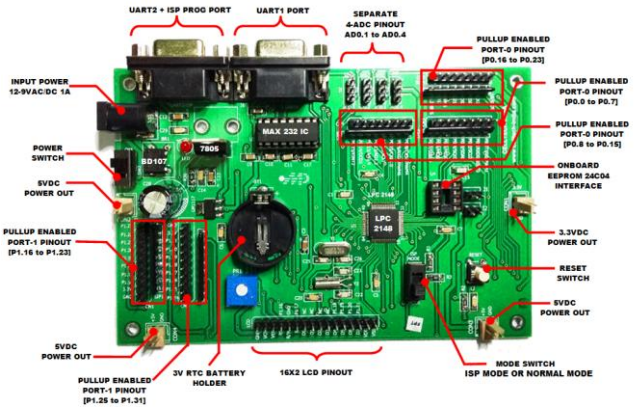

Fig. 3. ARM 7

Specifications:

1. Microcontroller: LPC2148 with 512K on-chip memory.
2. Crystal stone for LPC2148: 12Mhz

3. Operating Supply: 3.3V
4. Control on reset circuit with MCP 130T brownout location.

B. Power Supply

The contribution to the circuit is connected from the managed control supply. The microcontroller voltage is of 5V. The A.C. input i.e., 230V from the mains supply is venture around the transformer to 12V and is nourished to a rectifier. The yield acquired from the rectifier is a throbbing D.C voltage. So with a specific end goal to get an immaculate D.C voltage, the yield voltage from the rectifier is nourished to a channel to expel any A.C segments introduce even after correction. Presently, this voltage is given to a voltage controller to get an unadulterated consistent dc voltage. We are utilizing an IC 7805 as voltage controller to get a 5V yield Voltage.

C. IR Sensors

The regular 5V IR and Photo diode was observed to be adequate. The IR is controlled utilizing one of the advanced stick of the LPC 2148. The photograph diode and a 45kω resistor shape a potential divider course of action. The yield of the potential divider is given to one of the simple info channel of the LPC 2148.

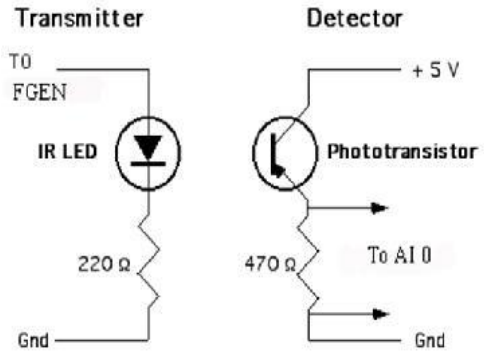

Fig. 4. IR Sensors

D. Ultrasonic sensor

Ultrasonic sensor HC-SR04 is utilized here to gauge separate in scope of 2cm-400cm with precision of 3mm. The sensor module comprises of ultrasonic transmitter, beneficiary and the control circuit.

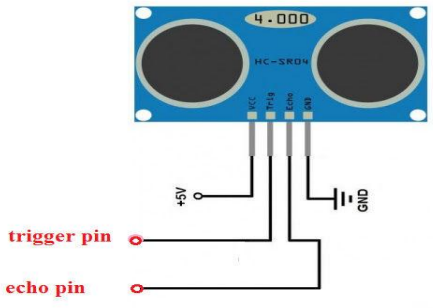

Fig. 5. Ultrasonic Sensors

E. DC Motors

To cross a separation of 22 Km in 4 hours, a normal speed of 1.5 meters/sec is required. The proposed configuration utilizes 4 DC engines (Torque Rating: 10Kg and Speed Rating: 500 rpm) interfaced with the LPC 2148 With a wheel breadth of 5.2 cm and the aggregate mass of around 5 Kg the rough speed of the robot is around 0.5 meters/sec. Thus it has been ascertained that three such robots would be required to check the entire Railway System.

Fig. 6. Wheels Motor.

F. Global System for Mobile communication (GSM)

Global System for Mobile Communications is a standard created by the European Telecommunications Standards Institute (ETSI) to depict conventions for second era (2G) advanced cell systems utilized by cell phones. GPS is an open, computerized cell innovation utilized for transmitting portable voice and information administrations. GSM systems work in various diverse transporter recurrence ranges, with most 2G GSM systems working in the 900 MHz or 1800 MHz groups. The longest separation the GSM particular backings in down to earth utilize is 35 kilometers (22 mi). GSM-R, Global System for Mobile Communications-Railway or GSM-Railway is a universal remote correspondences standard for railroad correspondence and applications. A sub-arrangement of European Rail Traffic Management System (ERTMS), it is utilized for correspondence amongst prepare and railroad direction control focuses. In our outline, the motivation behind the GSM is to send ready flag to the control room.

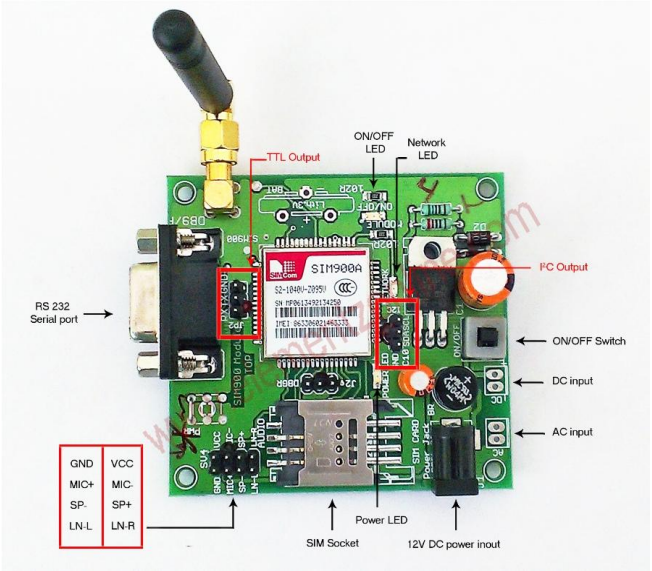

Fig. 7. GSM Module

G. *Global Positioning System (GPS)*

The Global Positioning System (GPS) is a satellite based route framework that sends and gets radio signs. A GPS beneficiary gets these signs and furnishes the client with data. Utilizing GPS innovation one can decide area, speed and time, 24 hours a day, in any climate conditions anyplace on the planet for nothing. GPS was formally known as the NAVSTAR (Navigation Satellite Timing and Ranging).

The premise of the GPS innovation is an arrangement of 24 satellites that are consistently circling the earth. These satellites are outfitted with nuclear checks and conveyed radio flags with regards to the correct time and area. These radio signs from the satellites are grabbed by the GPS collector. Once the GPS recipient bolts on to at least four of these satellites, it can triangulate its area from the known places of the satellites.

It is a higher execution, low power satellite based model. It is a financially savvy and convenient framework which precisely identifies the area. The GPS beneficiary utilized here is Sky Tram Venus 6 GPS module ST22 which is having TTL rationales and furthermore RS232 as choice.

The GPS beneficiary is appeared in Fig.5. This GPS is utilized to track the position of the prepare after the crisis brake is connected with a specific end goal to maintain a strategic distance from the mischances.

Fig. 8. GPS Module

Specifications:
1. 65 channels:1Hz Update rate.
2. Hot Start: 1sec.
3. Baud rate: 9600bits/s.
4. Operating Voltage: 5Volts dc.
5. O/P Format-NMEA 0183: RS232.
6. Operating Temperature: 40 to +85^{0}C.
7. Sensitivity- Tracking: 160 dam.
8. Reacquisition: 158 dam Cold Start (Autonomous): -148 dam.

V. RESULTS

The prototype of the Project is shown below,

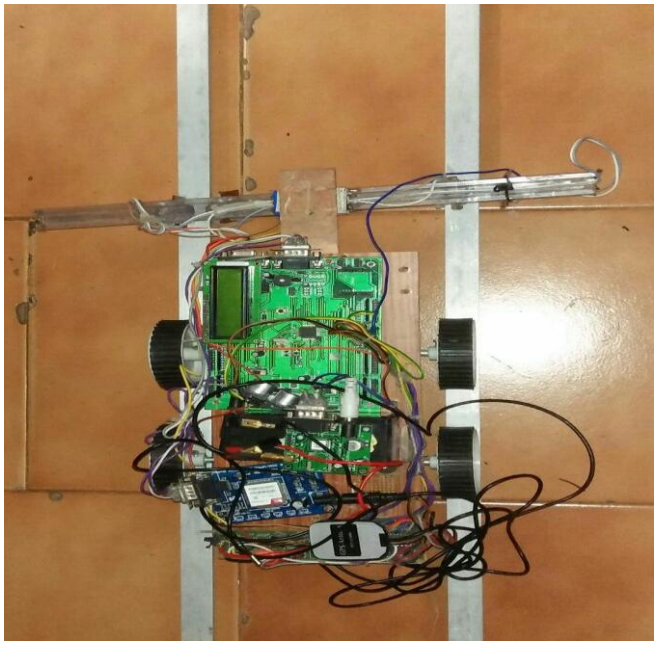

Fig. 9. Project Prototype.

The alert messages sent from the Robot are as follows,

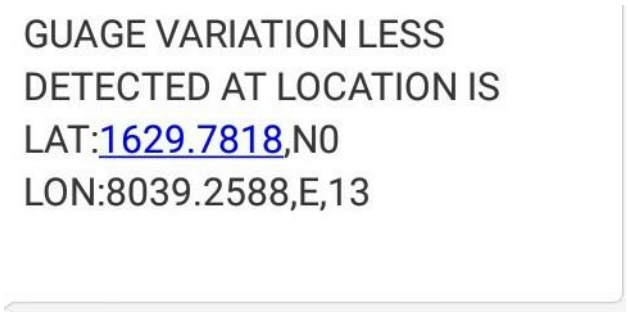

Fig. 10. Gauge Variation Alert

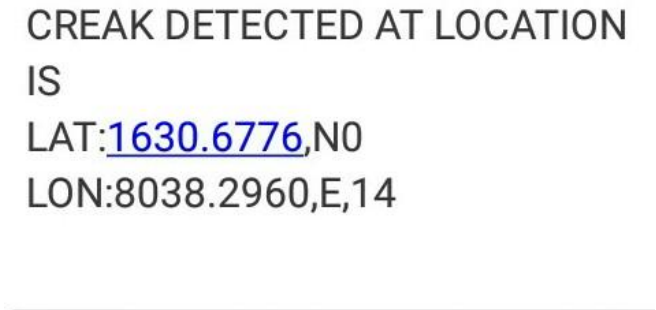

Fig. 11. Crack Variation Alert

VI. CONCLUSION

By utilizing the benefit of embedded system and sensors is study and detecting crack and gauge will be dissected in the reenactment stage utilizing implanted framework. In light of the four wheel robot (keen trolley display), all parameters are

kept in real life. The discovery of break and gauge are resolved and bring the correct area of variations from the norm and send it to the concerned expert to quick activity.

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