SOLAR POWERED GLEIS MISHAP SYSTEM WITH INTELLIGENT CHARGE CONTROL

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Abstract- In India rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain needs of a rapidly growing economy. Today, India possesses the fourth largest railway network in the world. However, in terms of the reliability and safety parameters, we have not yet reached truly global standards. The main problem about a railway analysis is detection of cracks in the structure. This paper proposes a cost effective solution to the problem of railway track crack detection utilizing solar energy and IR sensor assembly which tracks the exact location of faulty track which then mended immediately so that many lives will be saved. And it proposes to detect the forefront objects in the track to limit the accidents.

Index Terms- Energy management systems, Energy storage system, Automotive

I. INTRODUCTION

Transport is a key necessity for specialization that allows production and consumption of products to occur at different locations. Transport has throughout history been a spur to expansion as better transport leads to more trade.

The Indian railway network today has a track length of 113,617 kilometers (70,598 mi).over a route of 63,974 kilometers (39,752 mi) and 7,083 stations.

The rail network traverses every length and breadth of India and is known carry over 30 million passengers and 2.8 million tons of freight daily.

Despite boasting of such impressive statistics, the Indian rail network is still on the growth trajectory trying to fuel the economic needs of our nation. Though rail transport in India is growing at a rapid pace, the associated safety infrastructure facilities have not kept up with the aforementioned proliferation.

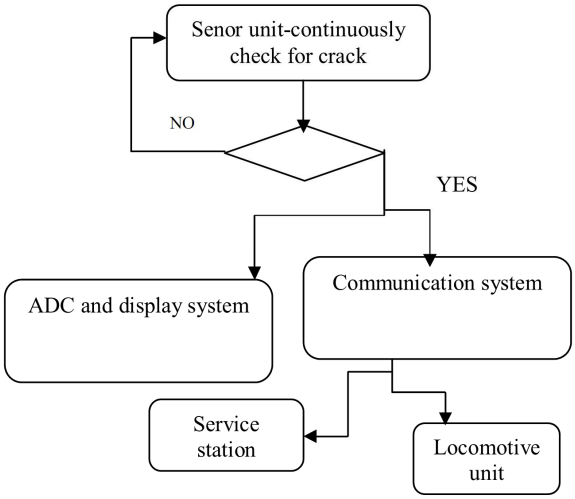
Our facilities are inadequate compared to the international standards and as a result, there have been frequent derailments that have resulted in severe loss of valuable human lives and property as well.

The principal problem has been the lack of cheap and efficient technology to detect problems in the rail tracks and of course, the lack of proper maintenance of rails which have resulted in the formation of cracks in the rails and other similar problems caused by anti-social elements which jeopardize the security of operation of rail transport.

This system aims to provide safety rail transportation during the course at the travel.

II. PROPOSED SOLUTION

B. Proposed Solution



As the diagram depicts this system has a sensing unit which continuously check for a crack. If it detects a crack the information of the crack is send to the locomotive unit and to the nearby service station. This system runs on solar power where the PhotoVoltaic panel cells used along with multi-power point tracking. The LCD display system depicts the measure of the crack on the track

Our model
This design is divided into 3 parts

1. Sensing unit
2. Communication system
3. The receiving unit

The implementation of this crack detection and object detection idea begins with the sensing of the crack or the forefront object. The functions are detailed below

Function 1
As the train moves the sensing module also starts to run ahead of the train. The distance between the two modules is adjusted to meet the requirements of speed to stop the train on the application of brake few meters ahead of the stopping location.

As the sensors and locomotive runs simultaneously, the speeds of the two modules are maintained uniformly, by the proximity sensors placed near the train wheel. On the event of crack detection in the IR sensor the receiver terminal receives signals when there is no crack the receiver does not receive any signal which changes the logic level. This signal is used as an interrupt to the controller. This information is transmitted through serial communication ports via a SIM module. The digital signal is converted to analog signals and displayed through the LCD screen. It measures the depth of the crack and sends the information to the locomotive as well as the nearest station. Depending on the depth of the crack, with the presets of the embedded codes the modules decide whether to stop the train or let go depending on the depth of the crack. The receiver modem converts this information as interrupt to stop the train. This information is also sent to the nearby service station.
Function 2
This function enables to detect the forefront object if there is any. It has the preset coding to detect the obstacle a few meters ahead, depending on the time duration of the obstacle in the rail track. The same process of sending the information to the locomotive unit and nearby stations is followed and the train halts depending on the time duration of the obstacle present. Above mentioned functions are co-ordinated by solar power unit which continuously powers up the devices .

III. IMPLEMENTATION

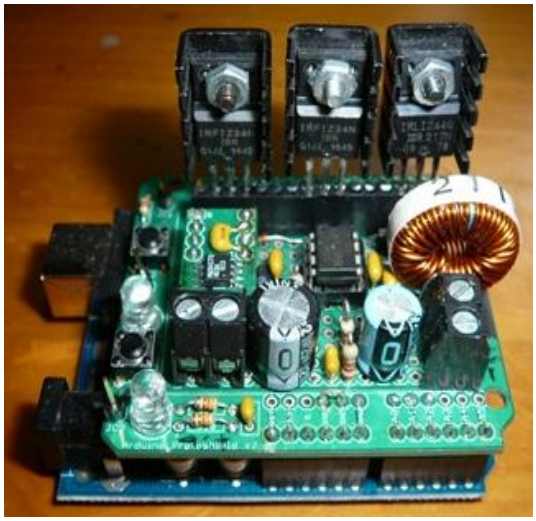
A. Hardware Implementation

Solar power supply
Photovoltaics play an important role in extracting solar energy. This system incorporates a solar power supply unit wherein photovoltaic panels are assembled along with multi power point tracking arrangement that extracts a maximum solar energy during the day time and the same is supplied for the system for all its actions .Unused energy is stored in a backup like solar battery using an intelligent charge control system

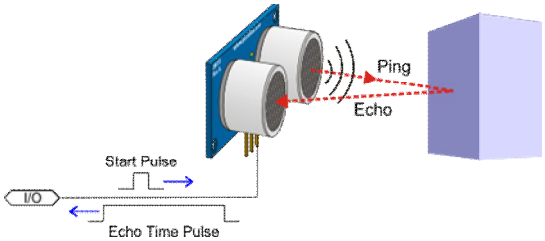
This intelligent backup system employs solar energy to supply electricity to charge two batteries at a time. They are generally portable. It works on the basic principle that solar energy can be converted into electrical energy. The output of solar panel is fed to the 3 terminals having connectors A, B, C through a polarity guard, current amplifier; regulator etc. heat sink is also provided towards the other end the batteries are interconnected such that the residual voltage is given a path to flow.

When a single battery is charged using a single solar panel, the load is concentrated on that single battery so, the battery becomes hot as it opposes the internal emf inside the battery .finally the battery becomes bulged and losses its life.Solely, the charging current is opposed by internal emf produced inside the battery which causes the battery which causes the battery to become hot and solar charger employs solar energy to supply electricity to devices or charge batteries. They are generally portable.

Such arrangement can also be used in addition to mains supply chargers for energy saving during day times and energy usage during night times.



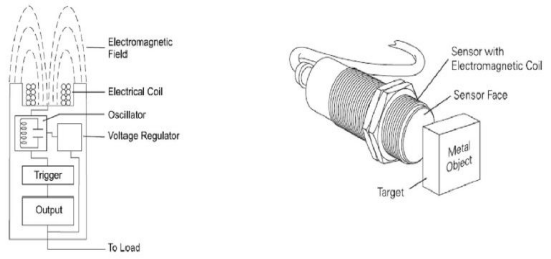
Ultrasonic sensors
Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.
Ultrasonic sensors are used to detect movement of targets and to measure the distance to targets in many automated factories and process plants. Sensors with an on or off digital output are available for detecting the movement of objects, and sensors with an analog output which varies proportionally to the sensor to target separation distance are commercially available. They can be used to sense the edge of material as part of a web guiding .



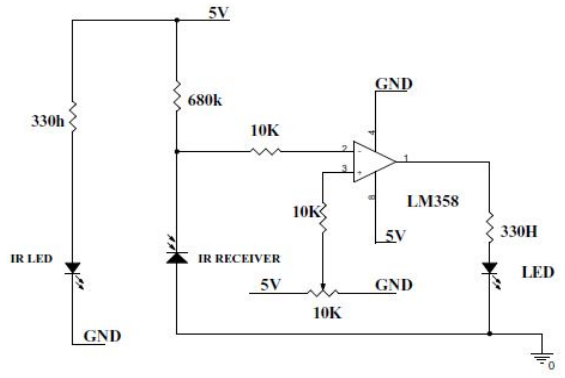
INDUCTIVE PROXIMITY SENSOR

A proximity sensor is a sensor which detects the presence of nearby objects called target without any physical contact. There are different types of proximity sensors such as inductive proximity sensor, capacitive proximity sensor, ultrasonic proximity sensor, photoelectric proximity sensor. Depending on the type of technology used proximity sensor emits an electromagnetic or electrostatic field, or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal when target comes closer to the face of sensor.

The inductive proximity sensor can be used to detect metallic targets only. The main components of the inductive proximity sensor are coil, oscillator, detector and the output circuit. The coil generates the high frequency magnetic field in front of the face. When the metallic target comes in this magnetic field it absorbs some of the energy. Hence the oscillator field is affected. This is detected by the detector. If the oscillation amplitude reaches a certain threshold value the output switches. The inductive proximity sensor works better with ferromagnetic targets as they absorb more energy compare to non Ferromagnetic materials. Hence operating distance for sensor is more for Ferromagnetic targets.



IR TRANSMITTER AND RECEIVER



Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other.

The transmitted signal is given to IR transmitter whenever the signal is high, the IR transmitter LED is conducting it passes the IR rays to the receiver. The IR receiver is connected with comparator. The comparator is constructed with LM 358 operational amplifier. In the comparator circuit the reference voltage is given to inverting input terminal. The non inverting input terminal is connected IR receiver. When interrupt the IR rays between the IR transmitter and receiver, the IR receiver is not conducting. So the comparator non inverting input terminal voltage is higher than inverting input. Now the comparator output is in the range of +5V. This voltage is given to microcontroller or PC and led so led will glow.



GSM/GPRS

GSM/GPRS RS232 Modem from rhydoLABZ is built with SIMCOM Make SIM900 Quad-band GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz0.It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with RS232 Level converter circuitry, which allows you to directly interface PC Serial port.

The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud mode. This GSM/GPRS RS232.Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface. The modem needed only 3 wires (TX, Rx, and GND) except Power supply to interface with microcontroller/Host PC. The built in Low Dropout Linear voltage regulator allows you to connect wide range of unregulated power supply (4.2V -13V). Yes, 5 V is in between!! .Using this modem, you will be able to send & Read SMS, connect to internet via GPRS through simple AT commands.

ADC CIRCUITRY

The ADC08L060 is a low-power, 8-bit, monolithic analog-to digital converter with an on-chip track-and-hold circuit. Optimized for low cost, low power, small size and ease of use, this product operates at conversion rates of 10 MSPS to60 MSPS while consuming just 0.65 mW per MHz of clock frequency, or 39 mW at 60 MSPS.

RECEIVING UNIT

Locomotive receiving unit

The locomotive receiving unit also has GSM MODEM and a display system to depict the

information of crack or the forefront object. On the reception of this data the train stops by the pre-fed embedded coding.

Receiving Station
The receiving station here is a mobile to suit the GSM MODEM communication. The mobile number is preloaded in the microcontroller program on the event of crack detection a message is sent to this receiving station. This implementation is used even for the object identification. On receiving the message the expert team would reach the location by the positional information's sent from sensing unit

B. Software Implementation
An 8052 microcontroller is used to program this system. It is loaded with the codes to make the system to respond crack or obstacle. An embedded C language is used to code this processor. The 8052 microcontroller is the 8051's "big brother." It is a slightly more powerful microcontroller, sporting a number of additional features which the developer may make use of:

- 256 bytes of Internal RAM (compared to 128 in the standard 8051).
- A third 16-bit timer, capable of a number of new operation modes and 16-bit reloads.
- Additional SFRs to support the functionality offered by the third time

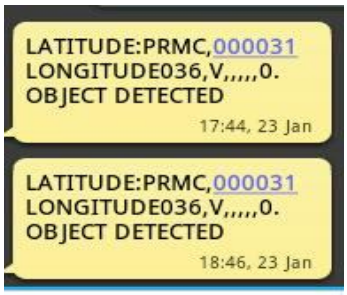
Interrupt mechanism
As the name implies, an interrupt is some event which interrupts normal program execution. As stated earlier, program flow is always sequential, being altered only by those instructions which expressly cause program flow to deviate in some way. However, interrupts give us a mechanism to "put on hold" the normal program flow, execute a subroutine, and then resume normal program flow as if we had never left it. This subroutine, called an interrupt handler, is only executed when a certain event (interrupt) occurs. The event may be one of the timers "overflowing," receiving a character via the serial port, transmitting a character via the serial port, or one of two "external events." The 8052 may be configured so that when any of these events occur the main program is temporarily suspended and control passed to a special section of code which presumably would execute some function related to the event that occurred. Once complete, control would be returned to the original program. The main program never even knows it was interrupted.

The microcontroller halts the locomotive through interrupt mechanism. The microcontroller receives four interrupts for various signals.
Interrupt 1: GSM MODULE for communication
Interrupt 2: Ultrasonic trans-receiver for object sensing
Interrupt 3: IR sensor for crack detection
Interrupt4: Proximity sensor for speed synchronization

IV. RESULTS

As in this plan a GSM based communication system is used hence a mobile phone is depicted as a service station to receive the messages from sensing unit. It displays the location of the crack or an obstacle. Here is the screen shots of the messages received from the sensor modem.

The message that shows the location of obstacle:



The message that shows the location of the crack:



CONCLUSIONS

The uniqueness of the plan as we consider is the solar powered and energy saving runtime detection of the crack on the rail which is not owned by any of the prevailing system. A few things that would have added value to the system that could be used in the future can be as follows

- For communication purpose the simple GSM [Global system for mobile communication] service can be replaced with that of the GPS [Global position system] so that communication is globalised.
- The flawless power supply, the sensing unit can be charged with power supply along the lateral sides of the rail track using a step-down transformer.
- Furthermore the sensing module can be reduced in size greatly to meet the developments in future.
- Like solar power unit also to supply power at night time lunar power unit shall be developed to extract energy from moon.

A seed is now sown. And hopefully in the future a fruitful contribution to freedom from accidents to ensure a secure train journey.

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