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Automatic Broken Railway Track Detection using GPRS-GPS

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ABSTRACT:*Cloud computing and Internet of Things (IoT) are two different developing technologies that become part of ourlife. Their adaption and usages are expected to be more and more effective. Railways are providing Eco-Friendly transportsystem for the mankind.The main objective of this paper is to make a simple, effective and portable robot for the identification of major railway track damages using Raspberry pie and Internet of things. It also uses a GPS system to get the exact location of the damaged track. A robot will move across the railway track with IR sensors placed on it to detect flaw on the track. Its location will be traced and will be transmitted to the main server.*

KEYWORDS: Raspberry pie;Internet of Things;GPS system;Sensors

I. INTRODUCTION

Te Internet of Tings (IoT) the system of physicalarticles - gadgets, vehicles, buildings and different thingsinstalled with hardware, programming, sensors, andnetwork connectivity - that empowers these items togather and exchange information2. Te Internet of Tingsallows objects to be detected and controlled remotelyover existing network, making open doors for morestraightforward incorporation of the physical world intoPC based frameworks, and bringing about enhancedsystem, exactness and economic advantage when IoT isexpanded with sensors and actuators.Safe transportation of travelers is the key businesstarget of any transportation framework. Railroadsare perceived as the most secure method of masstransportation and Safety has been perceived as the keyissue for the rail lines and one of its exceptional qualities.All business methodologies exude from this subject andEndeavour to accomplish Accident Free System.Wellbeing is, in this way, the key execution list

which the top administrations need to screen and makepreventive strides in light of patterns of mishaps. Fordetecting breakage of rails we are going to implementa new methodology for save the passengers from railaccidents and thereby increasing the growth of Indianrailways. Here in this methodology, initially the railwaytracks are integrated with modulated power supply,which transfers a specifc encoded data through therailway tracks. we connect number of sensors in variousdistances to read that specifc encoded data and thendecode it, the decoded data then compared with encodeddata to observe any data loses which further indicates thedamaged tracks in between two junctions, so based on thecomparison between encoded and decoded data, we canget the track status between two junctions. In this trackstatus can be updated to the 'smartliving.io' IoT platformusing RaspberryPi.

Existing Approach: Currently ZIGBI technology is being used for long rangecommunication; it can only be used for local networkswhere distance limitations are present. Tis is only usedto monitor tracks near to stations and it will indicateaccordingly. Te current system works through telephonicdiscussions for the choice of making track designation fortrains. There is extensive degree for miscommunicationof the data or correspondence crevice because of thehigher human obstruction in the framework. Thismiscommunication might prompt wrong assignment ofthe track for trains, which eventually prompts the trainimpact. IR sensors are likewise used to recognize thesplits in the railroad. IR sensors have constraints becauseof the geographic way of the tracks. Later land sensorshave additionally been utilized which makes utilizationof satellites for correspondence. Be that as it may, theframework is unreasonable and muddled to execute.

II. RELATED WORK

The detection offractures in such extensive system of 115,000 kmof track around the country increases

theprobability of error rate. Many derailment casesdue to track fracture have been cited even to thisdate. A few cases are cited below

a) On November 2016, a tragic derailment ofthe Indore-Patna train claimed the lives of147 passengers and 180 passengers wereinjured. The train derailed due to rail fracture near Kanpur.

b) On 28th December 2016, Sealdah-AjmerExpress derailed near Kanpur, whichreportedly has many rail fractures, and 22passengers were severely wounded.

c) On August 2016, 12 coaches ofThiruvananthapuram-Mangalore Expressderailed due to broken rails. Though thereweren't any casualties, it caused a lot oftraffic issues and property loss.

d) Jagdalpur-Bhubaneswar Express derailedon its way to Bhubaneswar claiming thelives of 27 passengers and 36 passengers were injured.

e) On January 2017, the Hirakhand expressderailed near kuneru in Andhra Pradeshkilling 41 people and inflicting injuries on68 people in an accident whose cause issuspected to be due to rail fracture.

Infig.1.collision, derailments, level crossing, misc.accidentsthese are the type of accidents with percentage.

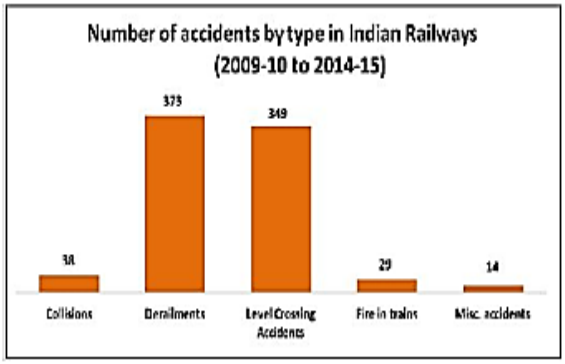

Fig.1.Perecentage of accidents (2009-10 to 2013-14)[3]

The fig.2.shows Cause of accidents in between 2009 to 2014 withdetails. There have been various causes for train accidentsranging from Human Failure to Equipment Failure. In the 6-year period between 2009-10 and 2014-15, human failure hascaused more than 86% of the total accidents. Out of this, 41%accidents were caused due to the failure of railway staff andthe rest due to the failure of others. Equipment failure causedonly 2.2% of the accidents[3].

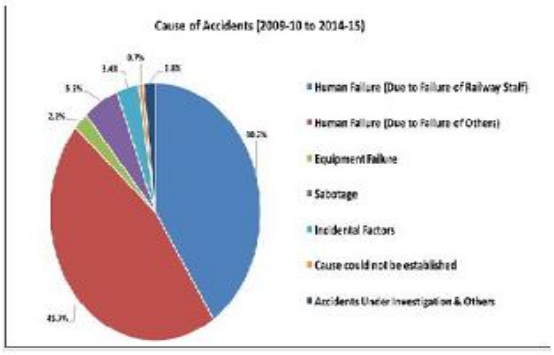

Fig.2.Cause of Accidents(2009-10 to 2013-14)[3]

III. PROPOSED SYSTEM

In this paper we are proposed Iot based railway tracksecurity system with Raspberry Pi. In this system our projectare detect the faulty railway track crack and also measure thedistance of two railway track. When Infrared (IR) sensor areused for find the crack in the railway track. If any kind of crack are occurred in the railway track means longitude andlatitude of this location are srnd to the nearststaion andultrasonic sensor are measured to the distance between thetwo track if any small variance means they detect and messageto the nearest station using GPS and IOT modem. ifany onepursuing on the track means they stop the surveying work aftercrossing rail road they are detect the track.If there is a crack in the railway track, it creates a majorproblem. Most of the accidents in the train are caused due tocracks in the railway tracks, which cannot be easily identified.Also it takes more time to rectify this problem. In order toavoid this problem, we are using the crack detector robot,which detects the crack in the rails and gives an alarm.A robotis an apparently human automation, intelligent and obedientbut impersonal machine. It is relatively, that robots havestarted to employ a degree of Artificial Intelligence (AI) intheir work and many robots required human operators, orprecise guidance throughout their missions. Slowly, robots arebecoming more and more autonomous.

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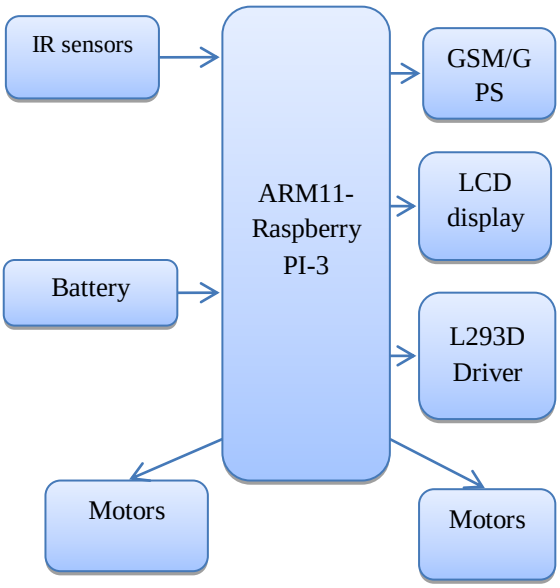

(a)

(b)

Fig.3(a) Block diagram (b)Server section

A. HARDWARE IMPLEMENTATION:

Raspberry Pi 3: The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B. Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processer, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.The main features of Raspberry pi 3 are[4]

Processor: Broadcom BCM2387 chipset.1.2GHzQuad-Core ARM Cortex-A53 802.11 b/g/n Wireless LAN and Bluetooth 4.1 (Bluetooth Classic and LE)

GPU: Dual Core VideoCore IV® Multimedia CoProcessor. Provides Open GL ES 2.0, hardwareaccelerated OpenVG, and 1080p30 H.264 highprofile decode.

Operating System: Boots from Micro SD card, running a version of the Linux operating system or Windows 10 IoT.

GPIO Connector: 40-pin 2.54 mm (100 mil) expansion header: 2x20 strip Providing 27 GPIO pins as well as +3.3 V, +5 V and GND supply lines

Infrared sensor: An infrared sensor is an electronic device, that emitsin order to sense some aspects of the surroundings.an IRsensor can measure the heat of an objects as well asdetects the motion .these types of sensor measures onlyinfared radition rather than emtting it that is called asapassive IR sensor. The IR Sensor-Single is a generalpurpose proximity sensor. Here we use it for collisiondetection. The module consist of a IR emitter and IRreceiver pair. The high precision IR receiver alwaysdetects a IR signal.[5]

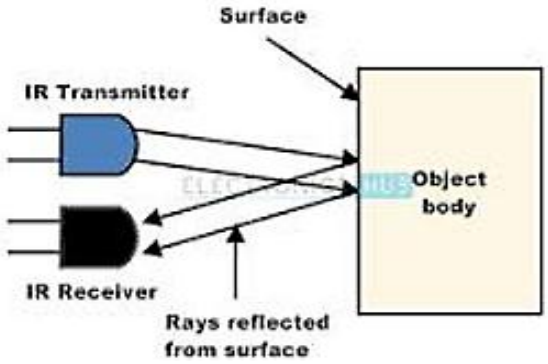

Fig.4.IR Sensor

DC Motor: The L293 and L293D are quadruple high-current half-Hdrivers. These devices are designed to drive a wide array ofinductive loads such as relays, solenoids, DC and bipolarstepping motors, as well as other high-current and highvoltage loads. All inputs are TTL compatible and tolerant upto 7 V. Each output is a complete totem-pole drive circuit,with a Darlington transistor sink and a pseudo-Darlingtonsource. Drivers are enabled in pairs, with drivers 1 and 2enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN.When an enable input is high, the associated drivers areenabled, and their outputs are active and in phase with theirinputs. When the enable input is low, those drivers aredisabled, and their outputs

are off and in the high-impedance.state. With the proper data inputs, each pair of drivers forms afull-H (or bridge) reversible drive suitable for solenoid ormotor applications.[1]

Fig.5.DC Motor

LCD Interfacing to Microcontroller: A liquid crystal display (LCD) is a thin, flat panelused for electronically displaying information such astext and integers. Its major features are its lightweightconstruction, and portability. Date and time arecontinuously displayed on LCD when the sensor valuesare being stored in EEPROM. Four data lines are usedto send data on to the LCD. When RS=0 and EN pin ismade high to low command is sent to LCD. WhenRS=1 and EN pin is made high to low data is sent toLCD. VEE is used to adjust contrast.

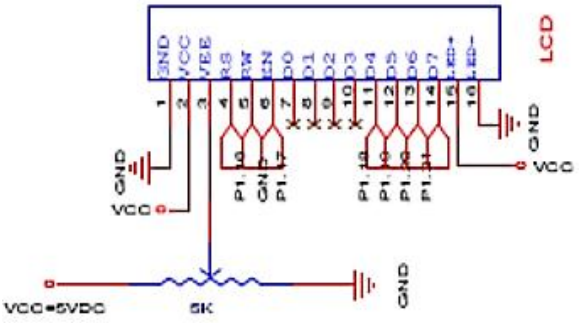

Fig.6. LCD connection

LEDs: The Light Dependent Resistor will monitor thelight intensity of the light intensity of surroundingenvironment. If the light intensity is getting low thenautomatically the LED lights will glow with a requiredintensity. Using the LED bulbs will save the energy inhomes and industries. Here we are controlling theintensity of the LEDs based on the outside light, so thatwe can save more power.

GSM module: It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. The use of GSM to send health information to webpage. This gives patient the ability to leave the hospital but still he has to stay in some known places to ensure the ability to reach him in emergency cases. Even with this solution the patient can't move freely and be far from his home.

GPS Module:LS20030~3 series products are complete GPS smartantenna receivers, including an embedded antenna and GPSreceiver circuits, designed for a broad spectrum of OEMsystem applications. The product is based on the proventechnology found in LOCOSYS 66 channel GPS SMD typereceivers MC-1513 that use MediaTek chip solution. The GPSsmart antenna will acquire up to 66 satellites at a time whileproviding fast time-to-first-fix, one-second navigation updateand low power consumption. It can provide us with superiorsensitivity and performance even in urban canyon and densefoliage environment. Its far-reaching capability meets thesensitivity requirements of car navigation as well as otherlocation-based applications.[1]

Fig.7.GPS Modules

Features:

- Ultra High Sensitivity and Low Power GPS Receiver Module
- MediaTek high sensitivity solution
- Support 66-channel GPS
- Fast TTFF at low signal level
- Support AGPS

Working: The functionality of the paradigm starts with the Infrared sensor

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i. When the vehicle is start, it moves along its path. TheInfrared Obstacle sensors sense the circumstance ofthe tracks.[1]

ii. When a determination of crack is detected by theInfrared sensor the vehicle stops at once, and the getthe coordinates of vehicle location through theGlobal Positioning System((GPS), the currentposition of the vehicle is received and the Latitudeand Longitude coordinates of the vehicle positionfrom satellites.[1]

iii. The Latitude and Longitude coordinates of vehicle isreceived by Global Positioning System(GPS) and areconverted into a message which is done by Raspberrypi.

iv. The Internet of thing(IOT) module sends the messageto controller and controller display the message onwebpage.

v. Once the message has been successfully sent to thecontroller , the vehicle restarts its movement forwarddepending on the type of crack.[1]

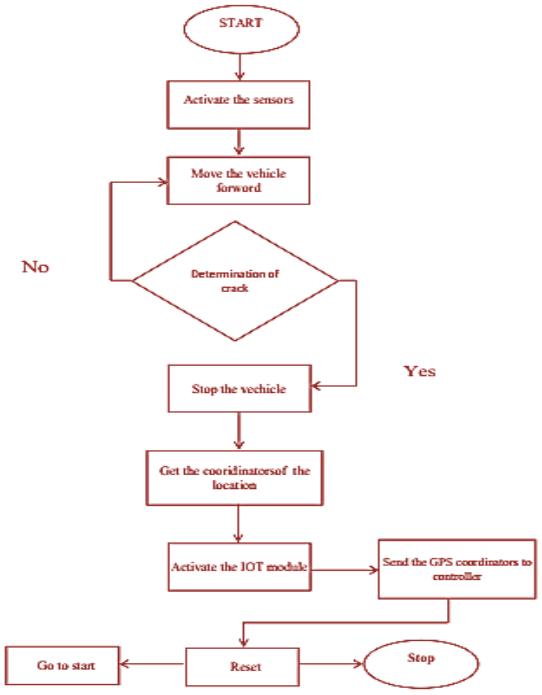

Fig.8. Flow Chart Of Proposed System

B. RESULT AND DISCUSSION

In the addressing experimental setup system is used to findthe crack in the railway track and send real time positionand orientation of GPS location to the control roomadministrator. So they will take sudden action against it.

Figure 9. Hardware Kit.

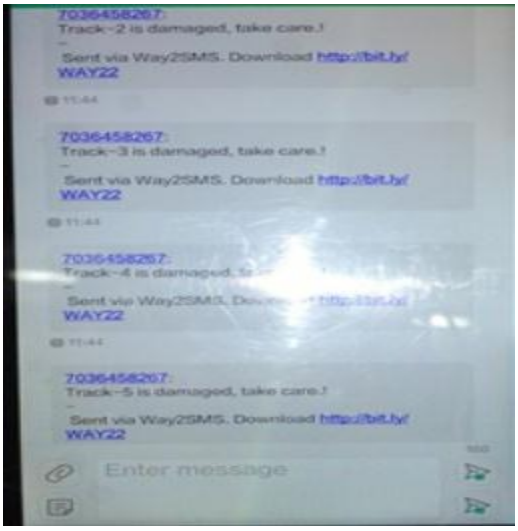

Fig.10. Screenshots of message alerts to mobile

IV. CONCLUSION

Digitalization of railway track has a large scope and havevarious applications like monitoring the environment duringfog conditions which are also the main reason for derailments.This project provides a unique approach towardsobserving the railways tracks in real time and sending the samedata in short span of time with the help of advancedtechnologies.The entire system is placed on a four wheeler botwhich travels along the rails. When compared toexisting system which uses IR transmitter andreceiver,

the proposed system is an innovativetechnique which lowers the burden of theauthorities and increases the accuracy of the crackdetection. The process is done at a periodic rate tocheck for cracks so that causalities can be avoidedentirely. The entirety of the model is to ensure thatdefective rails can be found in time to stopderailment of trains, to save the loss of lives andproperty.

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BIODATA

Kommu Renuka completed M.Tech (Embedded Systems).

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