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Wireless Based Collision Avoidance System for Railway Sector using Raspberry Pi

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Abstract :*Human negligence and human error have become the primary cause for train accidents in India. The objective of the paper is to eliminate train accidents by exploiting surveillance. Each locomotive is equipped with an automated surveillance system. The train tracks in railway network are segmented and given with distinct track numbers which are read by surveillance system inside the locomotive. This track number will be shared with neighbor trains using Radio Frequency Communication by the surveillance system. The system then compares its track number with neighbor train track numbers. On locating same track numbers, steps are taken by the surveillance system to caution the concerned motorman in order to stop the train and avoid mishaps. The paper proposes specific way of numbering the train tracks in segments. Also a communication protocol is proposed to ensure data transfer among Radio Frequency transceivers of the systems under half duplex mode. Railways are an efficient means of transportation as they transport a large number of people and goods simultaneously. Wireless Monitoring Unit (WMU) called as nodes are deployed at each end of the branch track to enable detection of the arrival and departure of the trains for the specific branch.*

Keywords *– Raspberry pi,GSM,GPS,Ultrasonic sensor,monitor.*

I. INTRODUCTION

Recent days are filled with train accidents all over the world. As per the report of CNN IBN India, dated September 14, 2011, 85% of the train accidents in those last four months are due to human error .The major reasons for such disasters are either human errors or technical errors which were due to less maintenance. The proposed method assists to conquer some of the major train risks. In this work a simple, economical surveillance mechanism is proposed to surmount the risks. In this work a simple, economical surveillance mechanism is proposed to surmount the risks. Vehicle tracking is one of the very important issues in this world in recent years. And even train tracking and monitoring is also an important crisis now a days. Because a train collision takes huge amount of human life and creating a massive loss to the railway sector in terms of money and time. So the system what we are proposing here is a real time wireless based, which will track trains through wired and wireless communication, make the communication between each trains through wireless, share their location details and track details between themselves. Our system is used for each train to identify they are travelling in which track number. Based on this, each train can calculate their distance from other trains and exchange emergency messages between other trains when they are near about few kilometers and travelling in a same track. Due to increase in population, there is a rapid increase in rail traffic. Increase in Rail traffic results in many electromechanical devices. The generator delay will help protect both the generating set and the appliances; a delay circuit allows the generator to run to full load, before connecting the load to it. The power indicator on the other hand gives the operator both visual and audio indication, when the public power is restored thereby reducing cost of power as it is cheaper to run on public power supply. This paper combines twin functions of automatic changeover and sequential (gradual or step) loading to eliminate the need for manual changeover, protect the loads, extend the lifespan of the generator and improve reliability of power supply. The importance of automatic change over and step loader cannot be over emphasized especially in critical industries like banking, telecommunications, defense, and healthcare where continuous

Wireless Based Collision Avoidance System for Railway Sector using Raspberry Pi operation is critical and interruption of power supply has grievous consequences. A sequential loader is used to ensure power gets to every load step by step. This is to ensure that power supply to the load is not accompanied by overloading of the generator. This device is derailments/collision of trains. Many a time collisions happens due to a train on the same railway track or due to some technical problem. For this many system has been designed. But they are designed by considering the mistakes made by Loco pilot. But every time it's not because of LP's mistakes.

Some accidents occur due to fractured tracks. We are proposing this system to avoid the collisions/derailments due to the crack or fractured in a railway tracks

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II. LITERATURE SURVEY

Index no.	Name of Research Paper	Authors Name and date of published	Work
1	RF based train collision avoidance system	Dr.M.geethanjali, K.P. Shantha Krishnan,G.Raji 13 February 2020.	Segmenting and numbering the tracks, results in sophisticated surveillance at ease of data handling.
2	Real Time Wireless based Train Tracking, Track Identification and Collision avoidance System for Railway Sectors	R. Immanuel Rajkumar, Dr.P. E. Sankaranarayanan, and Dr.G.Sundari 6, June 2014	Track Identification and Collision avoidance System.
3	Wireless Based Collision Avoidance System for Railway Sectors.	A. Mahesh, Ch. Balaram Murthy 7, July 2016	This system is having the dynamic nature to detect the objects in the track.
4	IoT-based Collision Avoidance System for Railways using Fog Computing	Prof. A. Haja Abdul Khader Dr. N. Jayaveeran April 2018	Features include train collision detection which notifies train drivers and the nearest station about the presence of another train on track which may cause collision.

Table 2.1 Literature review

III. SYSTEM DESIGN

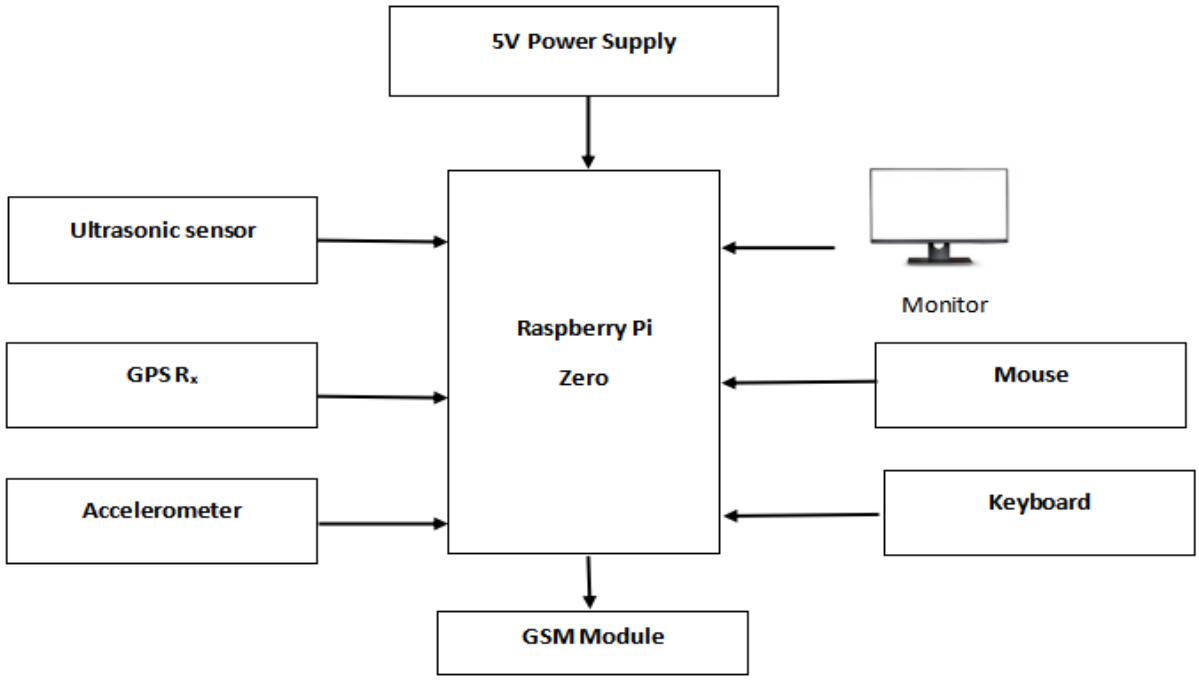

Figure 1 Bloack Diagram

Working:-

This Object Collision Avoidance for Train System consists of ultrasonic sensor, algorithm for sensing the collision, GSM module. This Object Collision Avoidance for Train System consists of ultrasonic sensor, algorithm for sensing the collision, GSM module.

a) Ultrasonic Sensor Module:-

The module mechanically sends the wave and mechanically sight whether or not receives the returning pulse signal. If the signals returning, through outputting high level and therefore the time of high level continued is that the time of that from the unbearable transmission to receiving.

b) The Algorithm for Sensing the Collision:-

When the collision is detect by using ultrasonic sensor which having the capacity to emit the waves immediately for transmitting and receiving in order to detect the obstacles in the track. The arm controller gets connect with the sensing module to sense the objects in the track.

c) GSM Module:-

When the collision is detected through the collision algorithm, the GSM module sends the message to the driver in order to prevent the collisions in the track.

d) GPS Module:-

The sensing information can be transmitted via GPS interfaced with the ARM microcontroller to identify the particular location of the obstacle where it is located can be previously identified and the warning can be given to the driver by means of alarm in order to stop the train.

e) MEMS Sensor:-

MEMS is a technology, which is used to detect the tilt of the movable train and it makes a alarm to the driver. They can able to take precautionary measures to save the passenger's lives.

IV. BACKGROUND WORK

5.1 Hardware Detail

1. Raspberry Pi Zero

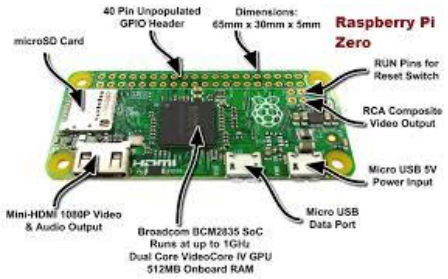

Figure 2 Raspberry pii

This is a super cheap single board computer. You get a working computer, it is cheaper than any Arduino controller board. Though is not a working computer yet, at least you have the motherboard although it has been a year after the release of Raspberry Pi Zero, it is still popular among the community and we carry it. Raspberry Pi Zero is a super-compact, hackable, and ultra-low-cost computer, This is the latest version (V1.3) with camera connector (CSI 0.5mm pitch to pitch).And there is no so call clone version of this super low-cost computer this is the original Raspberry Pi Zero

2. Ultrasonic Sensor

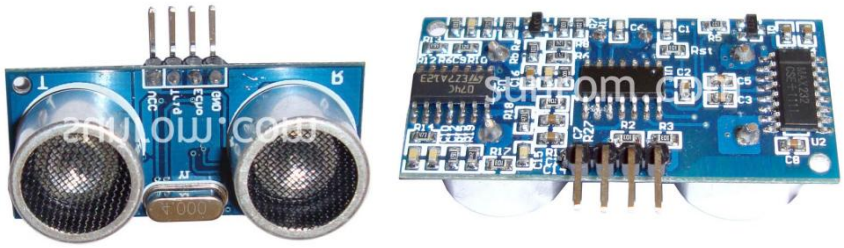

Figure 3 Ultrasonic sensor

Ultrasonic Distance Sensor provides range from very short (2 Centimeters) to long range (5 Meters) for applications in detection and ranging. The sensor provides precise and stable noncontact distance measurements from about 2 cm to 5 meters with very high accuracy. The ultrasonic sensor can easily be interfaced to microcontrollers where the triggering and measurement can be done using two I/O pin. The sensor transmits an ultrasonic wave and produces an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width, the distance to target can easily be calculated. This Ultrasonic Distance Sensor is perfect for any number of applications that require you to perform measurements between moving or stationary objects.

3. GPS

Figure 4 GPS

The Global Positioning System (GPS) is global navigation satelite system which use constellation of belween 24 and 52 Medium Earth Orbit satelites that transmit precise microwave signals, that enable GPS

receivers to determine their location, speed, direction, and time.GPS has become a widely used aid to navigation worldwide, and a useful tool for map-making, land surveying commerce, scientific uses, tracking and surveillance, and hobbies such as gro-caching and way marking Also, the precise time reference is used in many applications including the scientific study of earthquakes and as a time synchronization source for cellular network protocols

4. GSM

Figure 5 GSM

GSM stands for Global System for Mobile Communication. GSM is an open and digital cellular technology used for mobile communication. It uses 4 different frequency bands of 850 MHz, 900 MHz, 1800 MHz and 1900 MHz . It uses the combination of FDMA and TDMA. GSM (Global System for Mobile communication) is a digital mobile network that is widely used by mobile phone users in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies: TDMA, GSM and code-division multiple access (CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 megahertz (MHz) or 1,800 MHz frequency band.

5. Accelerometer

Figure 6 Accelerometer

Accelerometer sensor can measure static(earth gravity) or dynamic acceleration in all three axis. Application of the sensor is in various fields and many applications can be developed using this sensor. Accelerometer sensor measures level of acceleration where it is mounted this enable us to measure acceleration/deceleration of object like car or robot, or tilt of a platform with respected to earth axis, or vibration produced by machines. Sensor provides 0G output which detect linear free fall. Sensitivity can be adjusted in two ranges. Acceleration is a vector force which has direction and measured in meters per second. Earth

produces gravitational acceleration on all objects on earth. By monitoring the three axis acceleration one can measure the level of tilt of any platform

V. CONCLUSION

The propose collision avoidance systems are especially useful in bad weather conditions**.** A design for automatically averting train collisions and accidents occurring due to crack formation have been designed, simulated and tested. It uses the advanced features of PIC16F877 micro controller with ZIGBEE communication technique, proves to be effective in achieving the objects. It is applicable for many aspect of the railways for uninterruptible service. The silent features like saving human life, protection against accidents and the communicable electronic systems are the main advantage of this system. From the above discussion and information of this system we, up to now surely comes to know that it is highly reliable effective and economical at dense traffic area, sub urban area and the route where frequency of trains is more. As it saves some auxiliary structure as well as the expenditure on attendant it is more economical at above mentioned places than traditional railway crossing gate system.

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