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TRAIN COLLISION AVOIDANCE AND CRACK DETECTION USING GPS AND GSM MODULE.

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Abstract— *The railway is the most widely recognized and popular eco-friendly transportation system. It is generally utilized for a comfortable and safe voyage. Because of low fare and high volume capacity, nearly everybody can bear the cost of it. We all know the significance of human's life. In our country the preferred mode of transportation is through railroads. The accidents have occurred due to the obstacles in the railway track which cannot be identified at the right time. This has caused the loss of lives of many passengers. This project enhances the safety measures of those who travel through trains by avoiding the collision and detecting the cracks in tracks. The Zigbee will sense the oppositely coming train and transfer the data to the opposite train. The ultrasonic sensor will sense the crack and alerts the motor driver and stop the train automatically. The Zigbee is installed in the front of the train. If both the trains are on the same track both Zigbee sensors sense the same signal from opposite trains then it automatically applies a break and stops the train at a certain distance. The ultrasonic sensor which is interfaced with the microcontroller is used to detect the obstacle. GPS is used to locate the train after being stopped by detecting obstacles. This geographical position is sent to the control unit by using GSM. Thereby we can prevent the train accidents and save the human life.*

I. INTRODUCTION

This is a deadly train accident that happened in India. In order to reduce such train accidents this system helps much. This proposal pertains to a process for monitoring the condition of rail on train tracks. Ultrasonic sensors are fixed in the wheels of the train to find out the crack on the rail. Each sensor will produce the signal related position with the rail. If the track is said to be normal on its position when both the sensor gives the constant sensed output. If anyone misses their output condition to fail then there is defect on that side. It will be informed by GSM with GPS location in particular location. In this proposed system GPS sensor is attached in the two trains to monitor the current position of the train. The GPS sensor consists of GPS antenna and GPS receiver. GPS uses satellite ranging to triangulate vehicle position. In other words, the GPS unit simply measures the travel time of the signals transmitted from the satellites, then multiplies them by the speed of light to determine exactly

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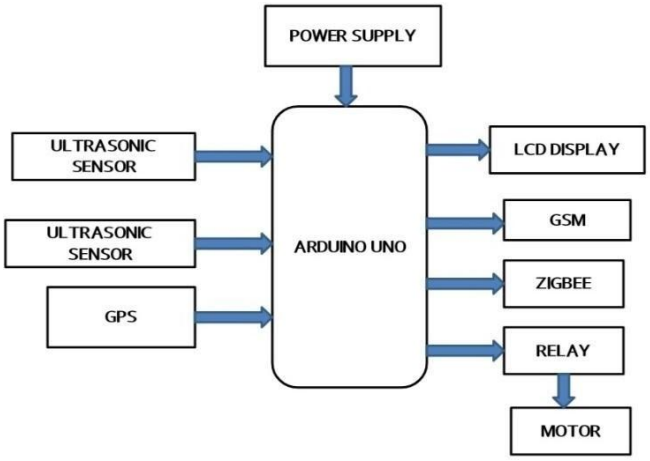
how far the unit is from every satellite its sampling.

By locking onto the signals from a minimum of three different satellites, a GPS receiver can calculate a 2D (two-dimensional) positional fix, consisting of your vehicle latitude and longitude. At the same time a speed sensor is used to measure the speed of both trains and it will transmit wirelessly using ZIGBEE. If both trains are on the same track both trains receive opposite train speed and train number using ZIGBEE Transceiver. So, it is very helpful to train drivers to know if any train is on the same track, then stop the train to avoid the accident.

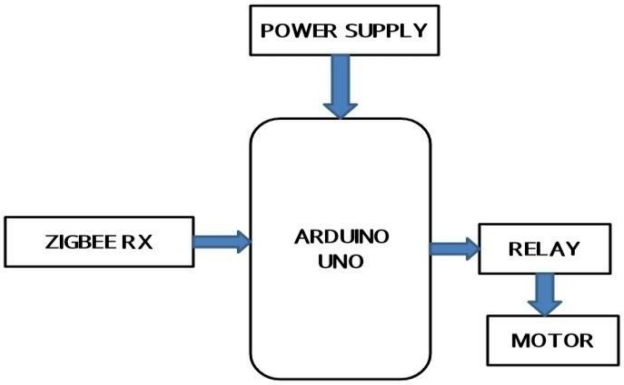
II. BLOCK DIAGRAM OF TRANSMITTER



TRANSMITTER:

The two ultrasonic sensors have been connected to Arduino, one sensor for detecting the crack and another sensor for finding the obstacle. If any obstacle is detected it will pass information to the microcontroller, where it will instruct the relay to stop the motor. In addition to that Zigbee is also used to transmit the signal, if the same signal is being detected in both trains, the motor gets stopped. Next if the crack is being detected, the motor will stop automatically. Once the train gets stopped, the GPS will get the location in terms of latitude and longitude, and share this message to the control through the GSM module. The LCD display will show the distance between the sensor and track. As it is a prototype, the code is written to detect the obstacle with the distance of 8 cm.

III. BLOCK DIAGRAM OF RECEIVER



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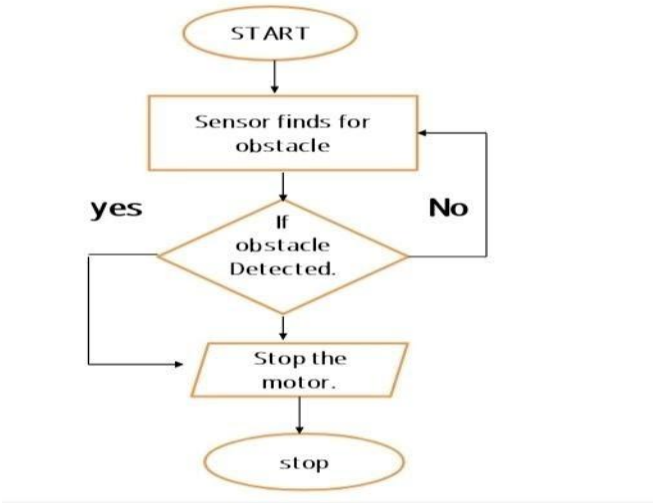
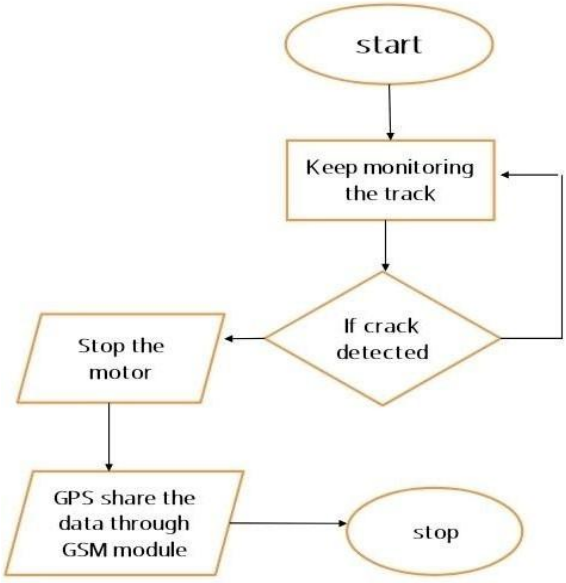
RECEIVER

The receiver contains the Arduino board, power supply, Zigbee receiver, Relay and the motor. If an obstacle is being detected, the Zigbee transmitter which is placed in the transmitter kid, will send the signal to the Zigbee receiver. The Zigbee receiver will transmit the data to the microcontroller (Arduino) which will stop the motor. So that the oppositely coming train also gets stopped if the train is being travelled in the same track.

FLOW CHART TO AVOID COLLISION



FLOWCHART FOR CRACK DETECTION



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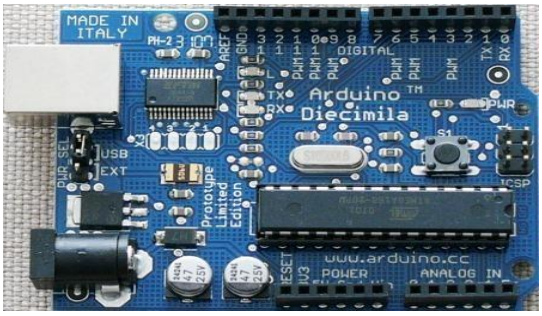
A. ARDUINO

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.



B. 2*16 LCD DISPLAY:

A liquid-crystal display (LCD) is a flat-panel display or other electronic visual display that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly.

C. ULTRASONIC SENSOR:

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object. It offers excellent range accuracy and stable readings in an easy-to-use package. It operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect).

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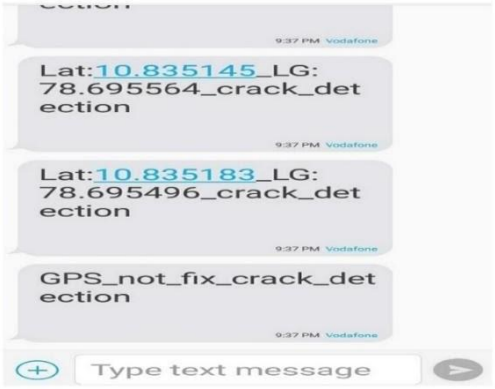
IV. RESULT



In the train collision avoidance, the forthcoming obstacle is detected by the ultrasonic sensor. The minimum range of the ultrasonic sensor is about 30cmrange. As this project is the prototype model the sensor will detect the obstacle in15 to 20 cm and then instruct the train to stop automatically. The time taken to detect obstacles and stop them is about 0.19 seconds. By this time the motor stops running, due to friction the train completely stops after travelling for few meters. In addition the Zigbee placed in the train will send signals, if the same signal is being detected by the opposite train, the brake will be applied. At last the collision can be avoided at a certain distance (most probably at 15 cm). Then the GPS Receiver will get the location of the train where it has been stopped and pass the information to the control station through the GSM module. The control station will receive the alert message in the LCD display. The second part of the project is crack detection, where the crack is being detected by the sensor and stops the motor rotation, thus the location of the train is being shared. Thus the train collision is avoided.

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