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Intelligent Railway Track Scavenging and Crack Detection Robot

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ABSTRACT

From time immemorial, scavenging rail tracks has been a puzzling social issue. The fact that humans have to clean human waste and other garbage thrown on rail tracks is a situation that needs immediate remedy. Manual scavenging is done now-a-days and many who are engaged for this job suffer from related health problems. The prevailing condition can be rectified to some extent by the adequate use of robotics and control technology. The proposed idea of intelligent railway track scavenging system comprises an intelligent vehicle that goes on the track. This proposed intelligent machine specially designed for the Indian railways can clean the railway tracks and detect the crack in a systematic manner. India has one of the world's largest railway networks, manual Inspection and detecting a crack on railways tracks is very tedious process and consumes lot of time and human resource. It consists of a four-wheel running robot with a Power supply unit, cleaning unit, sprinkler unit, Dual Tone Multi Frequency(DTMF) control unit, obstacle sensor unit, signaling unit, crack detection unit. The project aims in designing railway track crack detection system using LED and LDR sensor or optocoupler assembly. It detects the crack present in the track to avoid train accidents and also the obstacle present in the track. Also, the railways can save a lot of money on water and labour charges. It accomplished the functionality, critical in the waste clean-up in railway tracks, and has also tried to find solution for connected problems.

Keywords-*Crack detection,Dual Tone multi-frequency signalling(DTMF),Optocouplers,Railway track,Scavenging.*

I.INTRODUCTION

Indian Railways is one of the largest railway networks in the world. Railways cover the entire length and breadth of the country. It has a total track length of 115,000 km, with total number of railway stations in India is estimated to be between 8000 and 8500. It has come up as one of the nation's fast growing and profit making organizations. However, sadly enough, it has been years since the railways achieved complete sanitation. Open defecation through railways, unclean toilets, choked basins, and littered bogeys and tracks are the causes of the present poor sanitary condition of India's Railways. Disposing off the human excreta into the open tracks containing various harmful and deadly disease causing microorganisms. And of course, this kind of round-the-clock disposal of vast quantity of human waste in open environments to keep the trains clean is not at all healthy

and advisable. The garbage from pantry cars and tray loads of hot meals on station and in train are also thrown off through the doors and windows of bogeys onto the tracks polluting the stations and places all along the train's way.

India is travelling towards the dream "clean and green". Mere words create no impact on people. Preaching by action is our motto; our railway track cleaning machine keeps the railway track and its surroundings clean. This will motivate people to keep the city clean which will in turn help build a clean nation. Railway track cleaning machine is designed to provide the best cleaning facility with minimum power consumption and labor power. The existing cleaning process of the tracks and the railway platforms is manual, which is tedious and far from the desired level of sanitation or cleanliness. By virtue of the job, many of the workers develop serious health problems in course of time. This paper proposes that the prevailing condition can be rectified to a considerable extent by the adequate use of robotics and control technology. The Northern Railway is now undertaking a massive exercise to ensure cleanliness by using track cleaning machines. But the main problem facing by these machines are they are massive. This prototype is designed to remove waste (plastic covers, paper cups, polythene covers etc.) and store it in a separate cabin which would enable removal of all the wastes at once and detect the crack to avoid accidents. The tracks can then be cleaned with water using sprinkler, equal amount of disinfectant and pleasant smelling liquid.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. 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. The high frequency of trains and the unreliability of manual labor have put forth a need for an automated system to monitor the presence of crack on the railway lines. This system uses the crack detection robot, which detects the crack in the rails and stops the robot.

II.LITERATURE SURVEY

2.1 Manual scavenging deals with maintenance of hygienic conditions through services such as collection and disposal of solid and liquid waste using basic tools like thin boards and buckets or baskets lined with sacking and carried on the head [1][2].

2.2 By virtue of the job, many of the workers develop serious health problems in course of time. The health hazards include exposure to harmful gases such as methane and hydrogen sulphide, cardiovascular degeneration, musculoskeletal disorders, infections, respiratory system failure etc.Indian railways introduced this cleaning machine (designed and developed by Northern Railway capable of storing 6MT waste) in March 2014 [4].

2.3 Major disadvantage of this machine is that it requires very high power. Secondly, this machine also requires a separate engine. Considerable amount of human power is also inevitable to control the working of this machine. Lastly, the design of this system is different from commonly used compartments which makes it quite complicated to manufacture in other parts of the country other than where it is developed[5].

2.4 The Northern Railway is now undertaking a massive exercise to ensure cleanliness by using track cleaning machines [6].

2.5 The team of Northern Railway Diesel Loco Shed, Shakurbasti at New Delhi, has developed the concept for the design of very large, heavy- duty equipment mounted on a Railway wagon.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[7].

2.6 In previously existing system, the vehicle detects crack using sensor . The main drawback of the system is that these sensors could not detect every cracks in the track . These sensors were detecting the rivet fixed in track as crack. This was the major disadvantage[8].

2.7 The existing work involved in railway track crack detection is an autonomous vehicle using an PIC Microcontroller, obstacle Sensors assembly setup. This model detects the cracks along its path[9].

III. DESIGN COMPONENTS

3.1 POWER SUPPLY UNIT: 12 V DC supply is used for the functioning of the robot. 3.3V DC supply is used for microcontroller. All the other components in the robot utilizes between 5V to 12V supply.

3.2 CLEANING UNIT*:* A nylon brush is used to clean in between the track. Dc motor is used to run the brush continuously. Brush rotates in 360 degrees. The brush pushes the waste towards the bin.

3.3 SPRINKLER UNIT: There is a container to hold mixture of water and disinfectant. Mixture of water and disinfectant will be sprinkled immediately after cleaning continuosly. DC motor is used to pump the water.

3.4 CONTROLLER UNIT: The controller ARM7 LPC2148 are based on a 16bit/32bit ARM7-TDMI-S CPU. Architecture is ARMv4T. High speed flash memory ranging from 32kB to 512kB.A 128bit wide memory interface.Accelerator architecture enable 32bit code execution at the maximum clock rate 8kB to 40kB.On chip static RAM and 32kB to 512kB .On chip flash memory 128 bit wide interface enables high speed 60MHz operation. Up to 21 external interrupt pins available.

3.5 WASTE BIN MANAGEMENT UNIT: The waste bin will be full after few rounds ofcleaning.Then IR sensor is activated and the microcontroller detects whether the system bin is full. Then it will send SMS via GSM to the operator's mobile indicating replacement of bin.

3.6 WHEELS AND DRIVERS: This robot moves with the help of continuous track tyres.System runs on 4 main wheels works on differential drive motor. DC motor is used to continuously run the wheels. 4 motor drivers (L293D) are used.

3.7 OBSTACLE DETECTION: Ultrasonic sensor is used to detect the obstacles for wider range, approximately up to 30cm. This sensor is placed in front of the robot. It will send the data to microcontroller.

3.8 DISPLAY UNIT: A 16x4 LCD is used to display the status of robot, mobile commands, module names and sensed data from all sensors.

3.9 CRACK DETECTION UNIT:This application makes use of opto coupler.LED and LDR is used which is attached to the robot vehicle .And based on the interrupt received when there is a crack then the robot will automatically stop .It sends the information that crack is detected.

3.10DTMF DECODER UNIT: MT8870 decoder is used. This unit converts the commands given from the mobile and sends the data to microcontroller.

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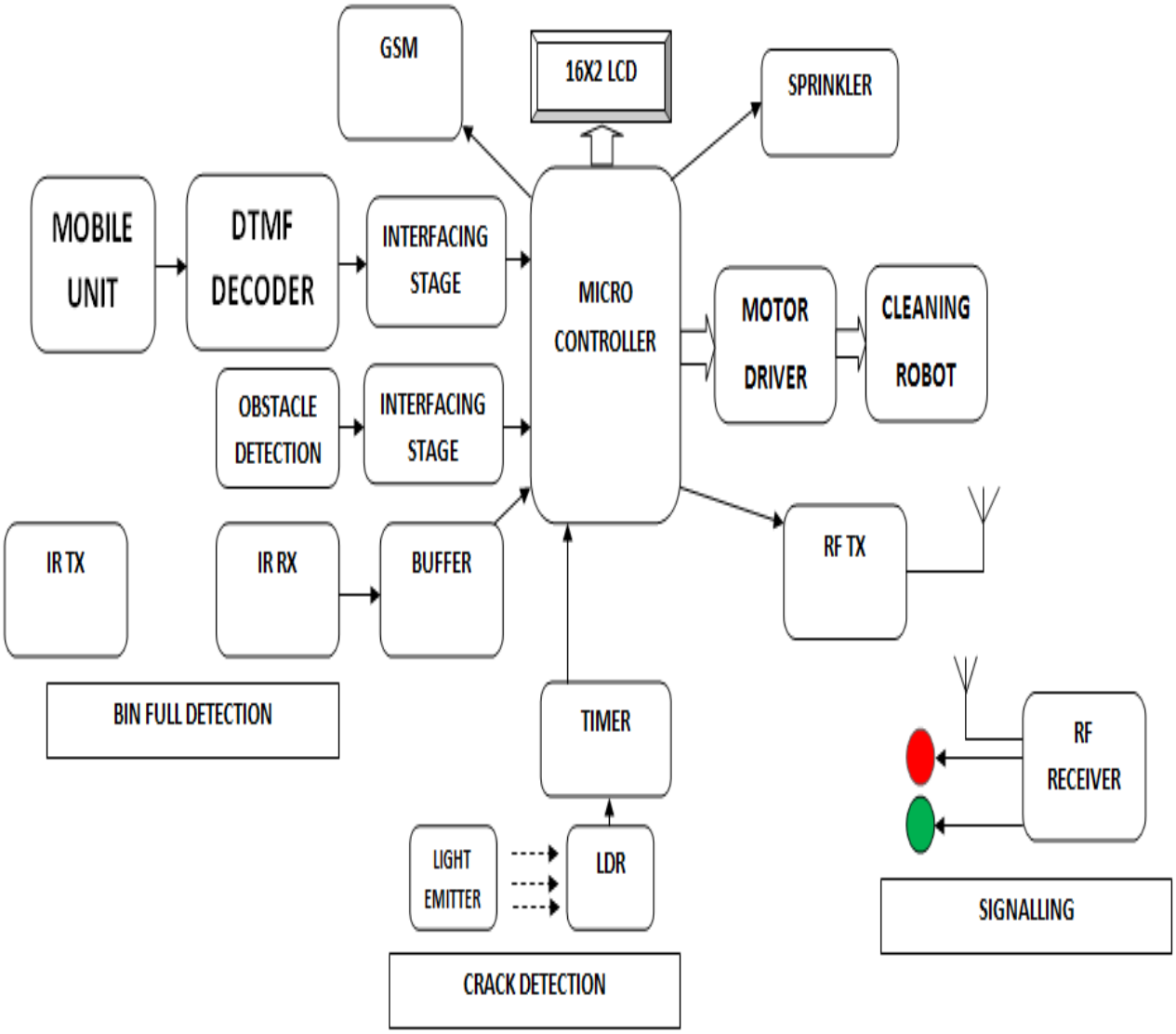
3.11SIGNALLING UNIT: When the robot is cleaning on the track, it sends signal to the nearest signal pole. This prevents the train approaching towards the particular trackto stop and resume its journey on the other track. Here RF transmitter is placed on the robot that sends the signal to the RF receiver present in the signal pole.

IV.BLOCK DIAGRAM



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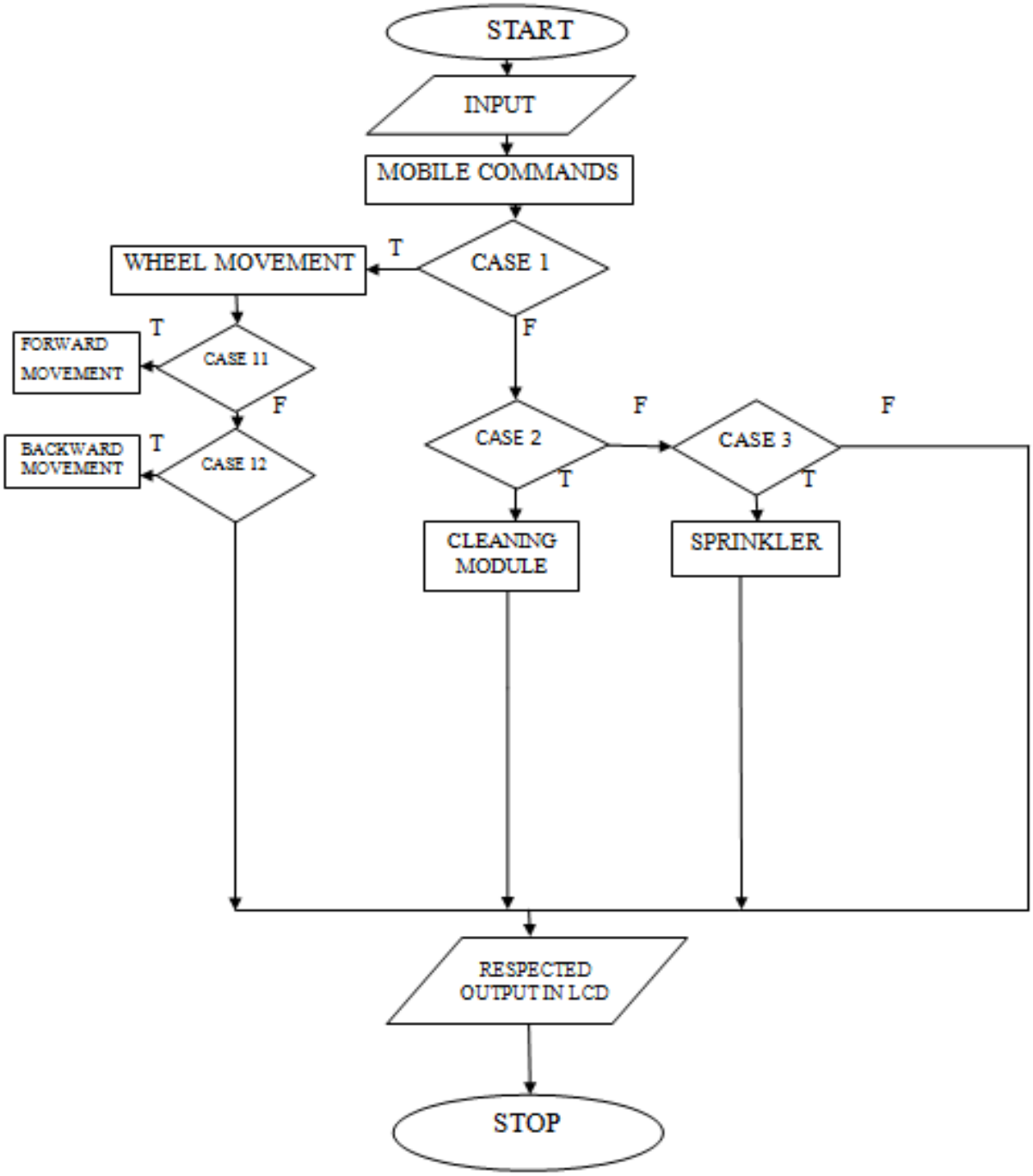
V.FLOWCHART



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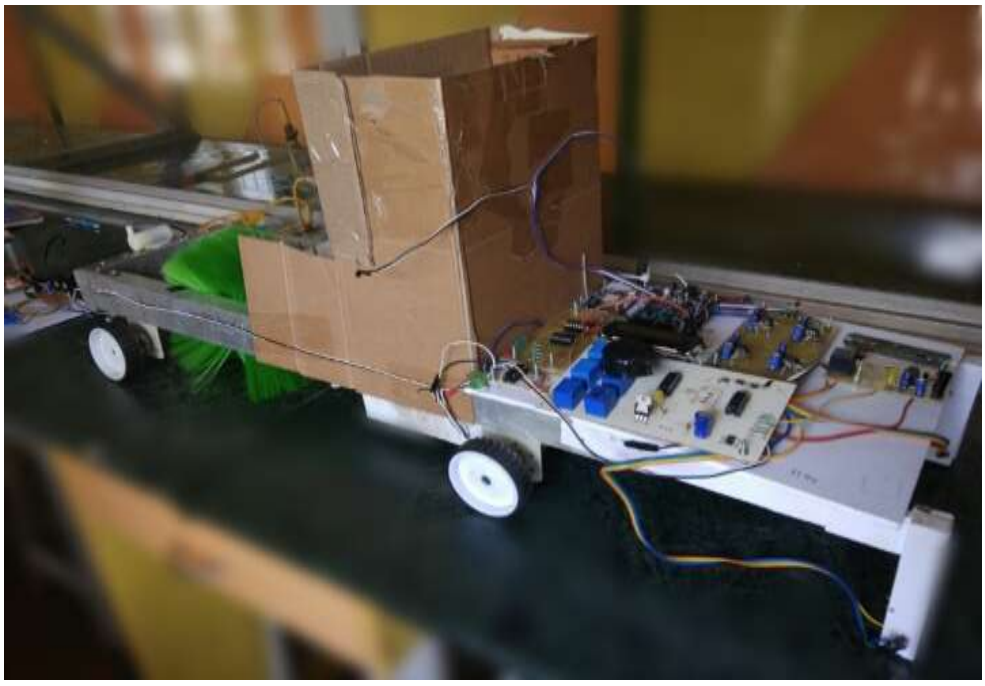
VI. OUTCOME

This robot cleans and collects the waste accumulated between the tracks, detects the crack in the track, detects obstacle present in front of the robot, sprinkles the mixture of water and disinfectant continuously after cleaning, gives red signal indicating that the robot is in cleaning process and gives green signal when cleaning is completed.



VII. CONCLUTION AND FUTURESCOPE

The Intelligent Railway track Scavenging and Crack detection Robot provides an efficient cleaning process and promises dirt free railway tracks in the stations with minimal human interaction. The proposed application of robotics can also be utilized for cleaning in emergency interventions. This Intelligent Robot is are evolutionary new way to clean around switching points. Intelligent Railway track Scavenging and crack detection Robot is a time-saver and dirt destroyer. Our proposed robotic application may serve in scenarios where manual scavenging is unhealthy. The system can be displaced and operated by external support making it user-friendly. It is eco-friendly as well. It maintains a log of cleaned and unclean area in the secondary storage. It can be made fully automatic. This Robot also finds the crack in the track that prevents train accidents. Intelligent Railway Track Scavenging and Crack detection Robot can be worked only in as specified range along the station.

A sponge can be attached at the end of this compartment which facilitates absorption of excess water accumulated on tracks during rainy seasons.

Derailing can be avoided. A camera can be interfaced for surveillance. Vacuum can be used instead of brushes to suck the waste.

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