

# Robot Based System for Cleaning between Railway Tracks

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## Abstract

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, owing to the peculiar nature of the job, 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 automatic railway track cleaning system comprises an automatic vehicle that goes on land and track. This device is the first of its kind proposed to be developed exclusively for the Indian Railways. Also, the railways can save a lot of money on water and labour charges. It has to accomplished some functionality critical in the waste clean-up in railway tracks, and have also tried to find solution for connected problems.

**Keywords:** Robotics, Automation, Railways, Labour.

## 1. Introduction

Track cleaning Robotics is a fascinating subject- more so, if you have to fabricate a robot yourself. The field of Track cleaning Robotics encompasses a number of engineering disciplines such as electronics (including electrical), structural, pneumatics and mechanical. The structural part involves use of frames, beams, linkages, axles, etc. the mechanical parts/ accessories comprise various types of gears (spurs, crowns, bevels, worms and differential gear systems), pulleys and belts, drive systems(differentials, castors, wheels and steering) etc. The pneumatics plays a vital role in generating specific pushing and pulling movements such as those simulating arms or leg movement. Pneumatic grippers are also used with advantage in Track cleaning Robotics because of their simplicity and cost effectiveness. The electrical items include DC and Stepper motors, actuators, electrical grips, clutches and their control. The electronic parts involves remote control, sensors (touch sensors, light sensor, collision sensor, etc), there interface circuitry and a microcontroller for overall control functions. Microcontroller used is AT89S52 form 8051 family to work in a serial communication UART mode the communication is configured on 9800bps to communicate it with the Bluetooth module. What we present here is an elementary robotic land rover that can be control remotely using primarily the RF mode. The RF remote control has the advantage of adequate range (up to 200m with proper antenna) besides being omni directional. On the other hand, an IR remote would function over a limited range of about 5m and the remote transmitter has to be oriented towards the receiver module quite precisely. However, the cost involve in using RF modules is much higher than that of IR components and as such, we have included the replacement alternative of RF modules with their IR counterparts for using the IR remote control. The proposed land rover can move in forward and reverse direction. You will also be able to steer it towards left and right directions. While being turn to left and right, the corresponding blinking LEDs would blink to indicate the direction of its turning. Similarly, during reverse movement, reversing LEDs would be lit. Front and rear bumpers are provided using long operating lever of micro switches to switch off the drive motors during any collision. The decoder being used for the project has latch outputs and as such you don't have to keep the buttons on remote control pressed for more than a few milliseconds. This helps prolong the

battery life for remote. The entire project is split up into sections and each section is explain in the sufficient detail to enable you not only to fabricate the present design but also exploit this principles for evolving your own design with added functions. To keep your design as simple as possible, we have coupled a 30rpm geared 6v DC motor to the left front wheel and another identical motor to the right front wheel. Both these front motors are mounted side by side by facing in opposite direction. Wheel rims (5cm diameter) along with rubber wheels are directly coupled to each of the motor shafts. This arrangement does not require separate axles. During forward (or reverse) movement of the vehicle, the two wheel shafts, as viewed from the motor ends, would move in opposite directions (one clockwise and the other anticlockwise). For reversing the direction, you simply have to reverse the DC supply polarity of the two motors driving the respective wheels. There are different methods available for steering a robotic vehicle. The commonly used ones are:

1. Front wheels are used for steering, while rear wheels are used for driving eg. Tractors.

2. Front wheels are used for steering as well as driving eg, in most light vehicles. In these vehicles (such as cars), the front wheels are coupled using a differential gear arrangement. It comes into play only when one wheel needs to rotate differentially with respect to their axes.

## 2. Motor control logic

Here is a typical circuit for driving one of the motors, in forward or reverse direction, coupled to, say the left hand front wheel. Simultaneously, the right direction for the moving the vehicle in the same direction. It means that input terminals of the motor drive circuit for the right hand motor have to be fed with reverse polarity control signals compared to those of the left hand motor drive circuit. The equivalent hex values of the binary control signals are indicated in table. It transpires that if we connect (short) input terminals A2 and B1 of the two motor control both the motors for forward, reverse left and right movement of the vehicle using the 3 bit binary number . This fact will be used while arriving at the integrated circuit for controlling the motors for appropriate movement of body. The Bluetooth module used is a HC-05 in smd package which works on a 3.3v and have a serial communication with any device connected to it the communication speed can be configured on various speed via AT Command. The BT module is a SPP supported profile so it can be connected easily to any module or phone. In this profile the data can be sent and receive to module. The BT module is connected to the RX pin of microcontroller. The L293D is a motor driver IC to operate the motors in any direction required dependent on the logic applied to the logic pins. A readymade compact size chassis I have used to avoid the chassis assembly the chassis contains 2 decks the lower is used for BO motors fitting the upper is used as a battery stack .on top the plate the board is mounted by screw fitting.

#### 4. Flow Diagram



Figure2. Circuit Diagram for Bluetooth module

The mechanical assembly of the rover is followed by proper placement of battery (6V, 4Ah), mounting of PCB and finally plugging the connector from the battery, motor and various LEDs mounted on the rover into the corresponding connector on the PCB before being able to control various motion of land rover remotely using either RF or IR principles-by simply shifting the jumpers in the remote transmitter and receiver PCBs towards appropriate position. Here are some useful hints and sequence for successful assembly of the land rover:

#### Conclusion

The future developments of Robots can be found in various places. The major among them is in the field of Development is going in the field of artificial intelligence. This will invoke thinking in Robots which in future will help Man kind in problem solving. Development is going on in the field of nano system which deals with implanting of small chips into human body for early detection of diseases. This can also help in locating a person by GPS technology.

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## Appendix

An appendix, if needed, should appear before the acknowledgments.

## Acknowledgments

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## References

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### 11.1. Journal Article

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