

# Design and Development of Human Waste Collecting and Disposing System in Railways

Sakshi Sharma<sup>1</sup>, Prashant Bhardwaj<sup>1</sup>

<sup>1</sup>Centre for Development of Advanced Computing, Mohali, Punjab, India

**Abstract**— The Indian railway is struggling with the lack of proper sanitation. The urinals and toilets in Indian trains are not well designed. They are designed in such a way that the waste from them is directly dumped on railway tracks. In the worst situation if the train is stopping at a station the waste will be dumped on railway tracks and these tracks are associated with that station. It will make the station, a dirty place. There is a need of proper sanitation in Indian railway. This research work presents the idea of a well-designed railway toilet for proper sanitation. The toilets are designed in such a way that they will not dump the waste on tracks.

**Keywords**—component; formatting; style; styling; insert (key words)

## I. INTRODUCTION

Indian Railways is a public enterprise, owned and operated by government of India through the ministry of railway. Indian railway is one of the world's largest railway networks. Railways have been good medium of transportation for its passengers (Railways are good medium of heavy and large amount of transportation in any country). Indian railway is known to be Asia's largest railway network. In Indian railways more than 40,000 coaches are used for passenger services. The only problem with Indian railways is the toilets on Indian railways are of open flush type. This leads to a hole in the floor, in which waste excreted by the passenger is discharge directly onto the tracks. Human waste is spread over India's 64,400 kilometers of rail lines. Human waste and urine contains very harmful germs. These germs pollute the environment and also responsible for causing many diseases like: hepatitis, diarrhea, cholera, waterborne disease etc. disposal of human waste in trains is the biggest problem that Indian railway is facing. Rail tracks get eroded on account of the release from toilets. According to a report given by UNICEF and WHO, 1/7<sup>th</sup> of the world population is still openly discharge waste due to the absence of toilets and out of that 60% lives in India. According to an estimate due to improper sanitation, yearly 10 million children die under the age of 5, globally, out of these 2.4 million children are from India. In India only 31% of population has access to proper sanitation facilities and only 11% of rural families dispose child waste properly. A yearly provide details regarding rail routes expressed that it is one of the minimum contaminating methods of transport. In this way, endeavors are being had to lessen the effect of the railroad operation on nature. In a nation where millions need access to fundamental sanitation, it is not surprising to see individuals urinating and crapping in broad daylight close prepares lines, especially in rural regions.

According to a report Indian Railway spend 350 crore rupee yearly on resolve rail corrosion. An action plan involving a multipronged strategy for development of Green Toilet is evolved in Jan 2010. One of the report from railway ministry said that the Indian Railways arrangements to introduce eco-accommodating toilets in all its 9,000 trains by 2011-13. Presenting the Railways Budget, union priest Lulu Prasad Yadav declared a procurement of Rs 4,000 crore for "release free green toilets" in each of the 36,000 mentors in the eleventh arrangement period.

This paper proposes an approach which gives a solution to the biggest problem facing by Indian Railways.

## II. RELATED WORK

A jointly working group which consists of Indian Railways engineer and DRDO biotechnologists, for joint development of Bio-Toilets [1]. Several techniques were proposed to solve the Indian railway toilet problem.

### a. Controlled Discharge Toilet System (CDTS):

Controlled Discharge Toilet System (CDTS) stores the waste and discharge the waste only after the train speed reaches 30kmph. Discharge of waste is done away from the station, so that the station should be kept clean. This system having a GPS attached to it, so that the waste dumping in designated areas can be prevented. 5300 CDTS have been installed in 1900 coaches [2].

### b. Zero Discharge Toilet System (ZDTS):

Zero Discharge Toilet System (ZDTS) having six compartments, in which one section contains a mixture of water and bacteria. In ZDTS solid and liquid waste are in different sections. ZDTS does not discharge human waste through it. This collects all the waste and then vermicomposed. Liquid waste is recycle and used for flushing. Anaerobic bacteria decompose the human/solid waste. The waste becomes organic fertilizer [3].

### c. Collection System using Wind Plate:

Prof. SajjanRao, a chartered engineer, has designed an automatic human waste collection and disposing system for railways and transport vehicles. According to prof. Rao, this system is environment friendly. It is having two models- flap valve and plug valve. These models having collecting chamber, discharge valve and wind plate at the lower end. Discharge valve automatically open and close by the action of wind plate. Wind plate will open and close with the force of wind, in the opposite direction of moving train. Different size of wind plate can be used and it decides at which speed of train, valve will operate. There is no need of electrical or

external power. Storage capacity of collection chamber is 40 lt. When the train is at station, human waste is collected into collection chamber. When the train starts and reaches to a pre-decided speed, discharge valve will open automatically and human waste discharge. Discharge valve remains open till the train runs at pre-decided speed [5].

These techniques have to face some limitations. These limitations are cost, complexity, requirement of external infrastructure, maintenance etc. Controlled Discharge Toilet Systems were expensive, costing around 6 lakh per piece [4]. Removing solid waste from tanks was a problem (ZDTS), Vacuum machines are prone to technical glitches [4].

Many passengers disregard the requests not to use toilets when train is at railway station. Apart from the unbearable disgusting odor it creates, the practice leads to choking of rail lines at busy stations. Disposing human waste in railway tracks is unhealthy. It may leads to many harmful diseases. Human waste can prove to be a serious health hazard, if it comes in contact with sources of drinking water. It is a good path for both viral and bacterial diseases. Every day, 3,980 MT of human waste is generated by the passengers who go directly onto the rail tracks and hence polluting the areas through which the trains pass. Due to this, environmental problems arise.

III. RESEARCH WORK

This proposed system comprises of two blocks: one is the engine block and other one is box or container block which is placed below the toilet. Container is operated by the engine.

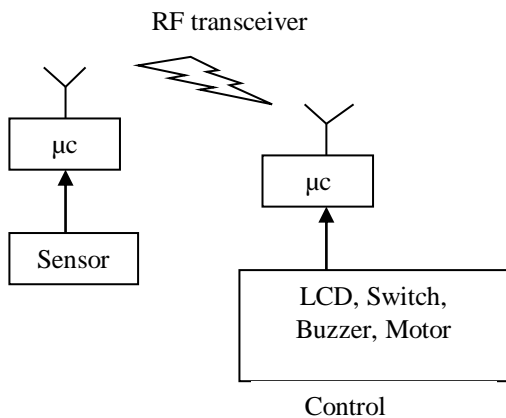


Fig.1: Block Diagram of Proposed work

Explanation of Proposed Block Diagram:

A. Microcontroller:

Microcontrollers act as the processing unit for the system. This will pick the signals from the sensors and process them to take appropriate action. It works as a bridge between signals and actions. Microcontroller controls the motor with the help of driver circuit.

B. Sensor

Sensor can be considered as transducer with an aim to sense or to detect various characteristics, changes or events of quantities and gives corresponding output mainly electrical or optical signals. For example, to convert temperature into output voltage, sensor used is thermocouple.

C. Control

Control unit constitutes of LCD, switch, buzzer, motor to perform numerous operations. Out of these LCD, buzzer and motor are output devices whereas switch is an input device. LCD is used to display full below the respective BOX. Buzzer rings when the BOX is full and switch is used to send a signal to motor. Motor is use to open and close the flap of box.

D. RF Transceiver

RF Transceiver which has frequency of 2.4 GHz has been used to transmit and receive respective signal from one module to another.

An Ultrasonic sensor is fixed on the container side. Ultrasonic sensor will continuously monitor the level of waste in the container. As the waste reaches to the threshold level, ultrasonic sensor will send a message to the RF transceiver module. At engine side there is other RF transceiver which will receive the signal coming from the RF transceiver at the container/box end. RF transceiver module is a wireless communication medium between engine and container. RF transceiver is interfaced with the microcontroller at the engine. The microcontroller will process the data received and display the specific box on LCD and at the same time buzzer will ring. Switch of specific container is pressed manually. Switch is interfaced with the microcontroller, which sends the data to the RF transceiver module. This data is send to the RF transceiver at container side. Microcontroller will process this data and runs the motor, to open and close the flap of container.

IV. RESULTS

When the level of waste reaches to the defined level then system alert the driver by displaying “Full”, on the LCD below each BOX. Figure 2 displays BOX1 full on LCD and figure 3 shows some waste in the BOX1.



Fig.2: LCD Display BOX1 Full



Fig.3: BOX1 containing waste

When BOX2 is full as shown in figure 4, LCD will display FULL below BOX2. Figure 4 shows waste in the BOX2 and figure 5 displays BOX2 full on LCD.



Fig.4: BOX2 containing waste



Fig.5: LCD Display BOX2 Full

## V. CONCLUSION AND DISCUSSION

The biggest problem in railways is that there is no proper disposing of human waste. Toilets in railways having a hole at the bottom and the waste will be disposed at the railway lines, which will lead to many diseases and it will also destroy the environment. In this thesis work, we are introducing a human waste collection system in railways. It can be used to keep the platform track neat. This will help in controlling diseases caused by human waste. As this is a collection process also, so, the human waste collected can also be used as a fertilizer. Human waste that has been treated by a hot composition process can safely be used to improve the soil for food crops.

## VI. FUTURE SCOPE

Proposed research work results with a cost effective and easy to use system which is very productive and effective. In order to improve or to make system more efficient following practices can be made in future:

- Solid and liquid waste can be collected in different containers or portioning of container.
- Whole system can be centralized by making a common control unit.
- Embedded system can be used for cleaning the containers also.
- System can be implemented in transportation mainly in long route buses.

## VII. REFERENCES

- [1] Virendra Kumar Yadav, Saumya Batham, Amit Kumar Mallik, "From Flush to Energy Model: Solution of World's Biggest Open Toilet (Indian Railway)," International Journal of Computer Applications, Volume 67– No.20, April 2013.
- [2] "Controlled discharge toilet system for Indian railway coaches", [http://www.rdso.indianrailways.gov.in/works/uploads/file/C-9906\\_Rev.4.pdf](http://www.rdso.indianrailways.gov.in/works/uploads/file/C-9906_Rev.4.pdf), february 2012.
- [3] "The Times of India, waterless urinals, Zero discharge toilets in kanpur", <http://timesofindia.indiatimes.com/city/kanpur/waterless-urinals-zero-discharge-toilets-kanpur/articleshow/46631729.cms>, march 2015.
- [4] The Times of India (November 28, 2012) "Railways need a bug to keep toilets clean" [http://articles.timesofindia.indiatimes.com/2012-11-28/chennai/35410640\\_1\\_toilet-system-discharge-toilets-inian-railways](http://articles.timesofindia.indiatimes.com/2012-11-28/chennai/35410640_1_toilet-system-discharge-toilets-inian-railways) ().
- [5] AnanthaSubramanyam K DNA, "Automatic waste collection and disposal system for trains" <http://www.dnaindia.com/bangalore/report-railways-might-get-better-toilet-systems-2005251>.



Sakshi Sharma is pursuing her Master's degree in Embedded Systems from C-DAC, Mohali, Punjab (India). She is working as Propaganda Secretary of Green ThinkerZ Society to promote environmental sustainability.



Prashant Bhardwaj has completed Masters of Technology in Embedded System from CDAC, Mohali. He has obtained his Bachelor of Technology degree in Electronics & Communication Engineering from Gautam Buddha Technical University, Lucknow in 2010. He has one year teaching experience in reputed Chandigarh University. His expertise includes electronics for medicine and biology.