

Embedded Based Autonomous Modular Lavatory System for Railways

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Abstract— In this paper we propose an Embedded based prototype design using Microcontroller and the pyroelectric infrared (PIR) sensor for human detection and control. Our design, the AMLSR (Autonomous Modular Lavatory System for Railways) is actually a prototype for real design which will be installed in every toilet in the Railway coach and it is made up of six blocks: the pyroelectric Infrared (PIR) sensor circuit, tap water valve controller circuit, Tank water controller circuit, Automatic door lock system, the Microcontroller, on-off control and the RF module. By using RF module AMLSR detects if train is arrived at station or not. If train has arrived at station tank valve will be closed in order to stop deposition of human waste on track. The PIR sensor circuit, detects if a human body is present inside the toilet or not. If there is no human body present the toilet tap valve will be automatically closed and door will be automatically get locked so that no passenger can use toilet while train is standing at station .the on-off control block is basically a switch which is placed inside railway and expected to operate by railway staff which is turned on before few minutes train leaves the station so that railway passenger can use toilets in emergency. This system will help keeping Railway stations clean and hygienic.

Index Terms— Microcontroller, Prototype, Pyroelectric Sensor, RF module

I. INTRODUCTION

In many developing countries, they still use traditional toilets in railways in which human waste from trains is to deposited directly onto the track using what is known as a hopper toilet which can causes health issues and unpleasant environment in railway stations Our system is solution for above problems Also this system is cost efficient and easy to develop and human efforts are reduced.

II. NEED OF PROJECT

].As huge amount of people travels through railways so keeping railway stations clean is important issue. The existing toilet system in the coaches discharges excreta

directly to the ground and the railway tracks. The consequences include unacceptable hygienic conditions, particularly in the railway stations. Hence, to make railway tracks at stations free from human excreta we required this type of approach.

III. OPERATION

Our Basic aim is to restrict human waste from toilets to deposit on tracks when train arrives at station and deposit the waste when train leaves station. For temporary storage of human waste intermediate tank is used [5].It has two way control solenoid valve to hold or release the human waste [6]. Also it is frequently announced at railway station and requested by placing boards at stations to not use toilet when train is standing at station so automatic door lock[4]. is placed to lock the door of toilet when train is standing at station only after sensing the presence of human body inside toilet using PIR sensor. RF transmitter is placed at every railway station and receiver is present in the railway coach, when train comes in the range of RF transmitter it receives the signal transmitted by Transmitter and send output to microcontroller to indicate that train has arrived at station and microcontroller takes decision.

IV. METHODOLOGY

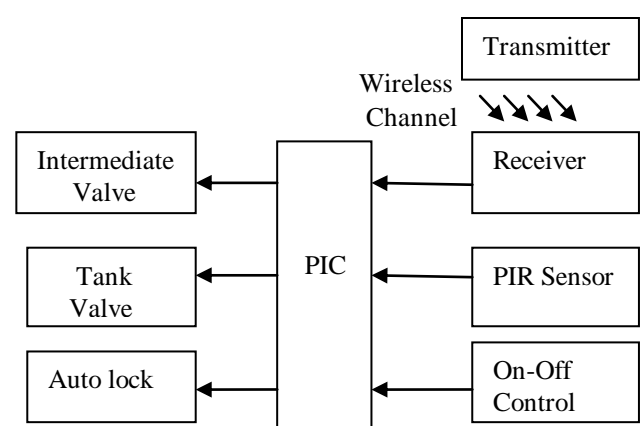


Fig (1). System block diagram

The radio-frequency (RF) electromagnetic (EM) spectrum, extending from below 1 MHz to above 100 GHz, represents a precious resource.[3] In this system RF module is chosen as it is easy to implement, inexpensive, used in variety of applications and it covers area of required amount also single transmitter can be used for multiple receivers and

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it consumes low power. RF receiver is present inside railway coach it will keep on detecting signal when it comes under range of RF transmitter it will catch the desired signal which indicates that train has arrived on station, and according to modes shown in Table. (1) System will work.

Table -1: Modes of Operation

Sr. No.	Train Position	Inputs	Tank Valve	Tap Valve	Auto lock
1	Outside Station	No inputs	Open	Open	Unlocked
2	Inside station	On-Off	Closed	Open	Unlocked
3	Inside station	PIR low	Closed	Open	Unlocked
4	Inside station	PIR not low	Closed	Closed	Locked

In first mode train is outside the station at that time tank valve will be open that means whatever waste is generated is deposited on track and door will remain unlocked and tap valve open. Tap valve is introduced in order to control flow of water in order to avoid overflow of intermediate tank if someone left tap open.

In second mode when train is arrived at station immediately tank valve will be closed as RF module will send signals to PIC microcontroller. Then Microcontroller will check two more inputs one is from PIR sensor and other From On-Off control switch. If On-Off button is pressed this is the condition that train will be departure soon and hence it is necessary that toilet should made available to passenger in this case there will be no further more actions will be taken by microcontroller it will continue same instructions that was just closing of tank valve. If On-Off control switch is not pressed then according to PIR sensor output further actions will be taken by microcontroller. If PIR detects a human body it will produce low output and microcontroller has to wait until PIR sensor output changes in order to lock the door. Once PIR output changes microcontroller will send signal to lock the door and to close the tap valve. As soon as train leaves the station RF receiver will stop detecting signal from RF transmitter this time tank valve will be open and tank will be emptied.

V. IMPLEMENTATION

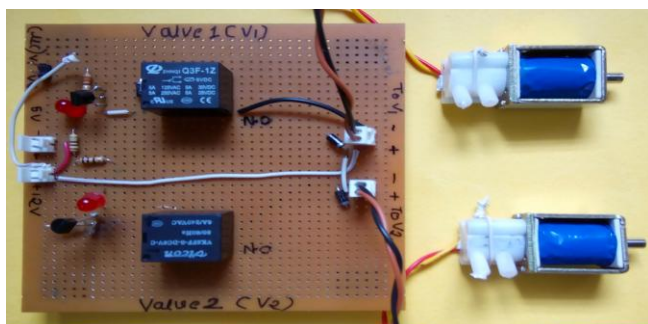


Fig (2). Picture Of valve Driver circuit

Solenoid valve used in this project requires 12 volt DC supply to work. As microcontroller has active high output 5 volts we cannot connect this valve directly to microcontroller hence this Driver circuit is required. The solenoid is controlled by a cascade-switched circuit. A digital output pin of the PIC microcontroller is connected to the base of a transistor which controls the current to a normally open, SPST relay. When the relay coil is energized, it closes the contacts, which allows current from the 12V supply to flow through the solenoid. When the solenoid coil is energized, the valve opens, allowing water to flow.

VI. CONCLUSION

Cleanliness of railway stations can be effectively managed since solid waste from Railway toilets is properly handled. Cleanliness, Sanitation is maintained, unpleasant smell and spreading of diseases can be reduced much better. This makes the Railway passenger's more pleasant Environment. At present, there are many Railway lavatory Systems present worldwide. Though, this project distinguishes itself by its less cost and easy utilization.

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