SMART DUSTBIN

[1]TWINKLE SINHA, [2]K.MUGESH KUMAR, [3]P.SAISHARAN

[1,2,3]Information and Telecommunication, SRM University, India
E-mail: twinklesinha511878@gmail.com[1], blackpearlson@gmail.com[2], saisharan.p@gmail.com[3]

Abstract- -Municipality takes many measures to maintain the cleanliness of the city. One of which is establishing dustbins in regular distance for the convenience of public to discard items. Cleaning this garbage is an important function of municipality which is directly related to health issues. We have designed a model for a 'Smart Dustbin' which indicates directly that the dustbin is filled to a certain level by the garbage and cleaning or emptying them is a matter of immediate concern. This prevents lumping of garbage in the roadside dustbin which ends up giving foul smell and illness to people. The design of the smart dustbin includes a single directional cylinder and an Arduino Uno. The circuit to power up the mechanical devices is also assembled to obtain the desired simulation.

Keywords- Lumping of the garbage, microcontroller, the single directional cylinder, smart dustbin.

I. INTRODUCTION

Dustbin is a common and a basic need everywhere. It is observed that often the garbage get accumulated due to irregular removal of garbage present in the dustbin. Here we have figured out a new model for the municipal dustbins which intimates the centre of municipality for immediate cleaning of dustbin. This dustbin is also designed to compress the garbage periodically thus preventing the unnecessary occupying of dustbin's space by light weighted but space occupying garbage particles like sponges, etc. A leaf switch is pressed by the garbage when it reaches a particular level and an Arduino Uno is programmed in such a way that when the garbage reaches this particular level, intimation is given to the central hub in the form of glowing of LED.

II. NEED FOR A SMART DUSTBIN

Bad waste management can easily result in air pollution and soil contamination. They have an adverse effect on human health. It is learnt from the primary survey done in Guwahati, a city in Assam that garbage accumulation causes 41% of the air pollution [1].They cause air pollution which generally leads to various respiratory problems like COPD, asthma etc. Breeding of mosquitoes and houseflies occur mainly in garbage which are a major cause for various diseases like malaria, dengue, chikungunya etc. This also causes headache, nauseous sensation and increase in the stress level. A city with poor sanitation and smelly environment can never be a healthy place to live in. There are about 235 million people currently suffering from asthma for which foul smelling of garbage is also a vital reason. Almost 90% of chronic obstructive pulmonary disease (COPD) occur in low and middle income countries which is caused by foul smelling. More than 3 million people died of COPD in 2005[2]. Improper management of garbage is identified to be one of the major causes for 22 human diseases causing premature death every year [3].

Implementation of this smart dustbin can prevent lumping of the garbage for a longer period of time thereby preventing the widespread of diseases to a great extent and promising a clean environment in the city.

III. DESIGN OF DUSTBIN

A single directional cylinder is suspended next to the lid of dustbin. The piston is free to move up and down vertically inside the dustbin to a certain level. A plate is attached to the cylinder for compressing the garbage. The shape of this plate depends upon the shape of the dustbin. The compressing plate consists of a side hole through which the leaf switch is suspended upside down. The level of leaf switch is placed lower to the maximum level to which the compressing plate can reach down thus even after the switch gets pressed, garbage can be dumped in the dustbin to a certain extent.

The opening of the dustbin is located little higher to that of the threshold level. The opening of the dustbin is covered by a lid that is attached to the inner lateral surface of the dustbin.

Thus when the compressor reaches the maximum level for compression, it blocks the inlet lid such that no garbage from outside can be dumped into the dustbin during the while. Preventive measure is taken in such a way that the garbage do not damage or block the functioning the leaf switch at any case. The materials used for designing the dustbin and the compressor is selected in such a way that it exhibits anti corrosive properties.

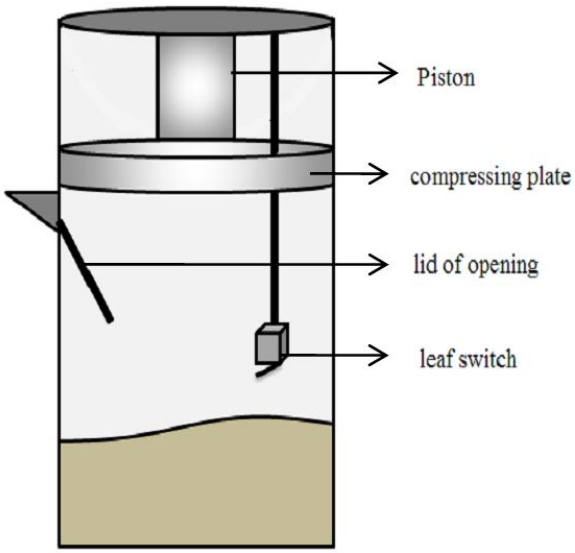

Fig.2 Dustbin before compression

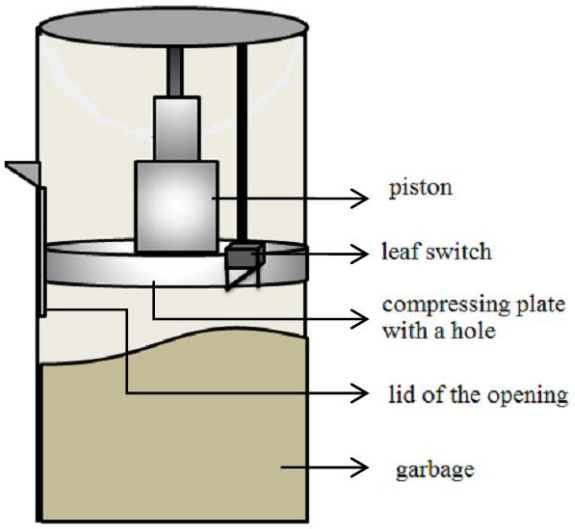

Fig .3 Dustbin during compression

IV. PRINCIPLE AND WORKING

The design of the smart dustbin includes the pneumatically automated compressor for compressing the garbage, electrical circuit to control the garbage compressor and a microcontroller which is used to intimate the central hub of the municipality.

A. Pneumatically automated cylinder for compressing the garbage

The light weight garbage particle generally occupies space in the dustbin but does not consume the actual volume of its dimension. Thus, if the dustbin is filled with light particles, they reach the level of dustbin easily without occupying the complete volume of the dustbin. To overcome this, we are using a single directional cylinder that moves up and down to a particular level for compressing these particles inside the dustbin that is pneumatically moved using 3/2 solenoid valve, air compressor, terminator and actuators. An electrical circuit is used for the automation of this device. The circuit is simulated and verified using Festo Fluidsim 4.2. Festo Fluidsim is a simulation software used for performing different types of mechanical operation which helps in visualising the pneumatic, hydraulic, and electrical and electronics (digital components and circuits) mechanisms.

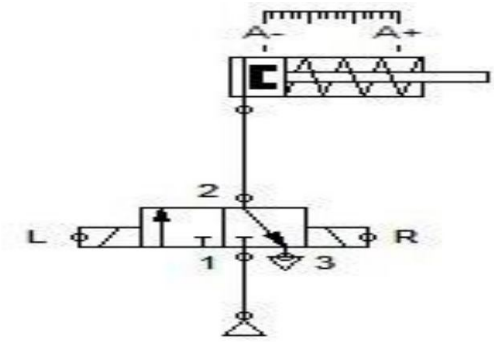

Fig.4. design of dustbin compressor

B. Design and working of the cylinder

A single directional cylinder consisting a compression plate is connected to the 3/2 solenoid valve at position 2. The compressing plate consists of a hole through which the leaf switch passes upside down. Actuators are placed on the right (R) and left (L) sides of the solenoid valve. Position 1 of the valve is connected to the air compressor and position 3 is connected to the terminator. Now when L actuator gets actuated, the position 3 of the valve changes to the position 1, this position is connected to the air compressor which allows the air to pump into the cylinder. Because of this developing pressure in the cylinder, the piston starts moving from position A- to A+ which are actuating controls. Next when the R actuator gets actuated the position of the valve changes from position 1 to 3 where terminator is connected. This allows the developed air pressure in the cylinder to drive out of it. Now because of the spring action taking place in the single direction cylinder the piston moves back to position A-.These mechanical devices are coated with anticorrosive materials in order to prevent rusting of devices as they are prone to moisture.

C. Circuit for automation of cylinder

To make the movement of cylinder automatic and periodic process an electrical circuit is designed and is described. The circuit consist of push button make switch, push button break switch, a relay, 3 make switches, 1 break switch, on delay timer and actuators. When the power supply is given to the circuit, the push

button make switch turns ON which activates the circuit. Thus the relay (R1) is also activated. The switches R1 (1) and R1 (2) which are connected to relay (R1) are turned ON which in turn start the on-delay timer (T1). At the instant of the zeroth second of the timer, the switches which are connected to the timer, T1 (1) and T1 (2) are activated i.e. a break switch in node 3 line is short circuited and make switch at node 4, makes the line by turning the switch ON. This in turns actuates the actuator L. Because of this actuation produced on the valve, the position of the valve changes to the compressor. The compressor sucks the atmospheric air and compresses it. This pressurised air moves the piston to A+ position.

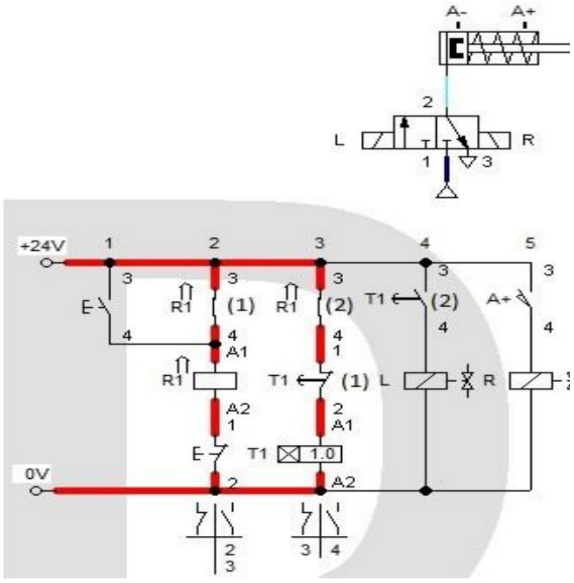

Fig.5 The compressor circuit.

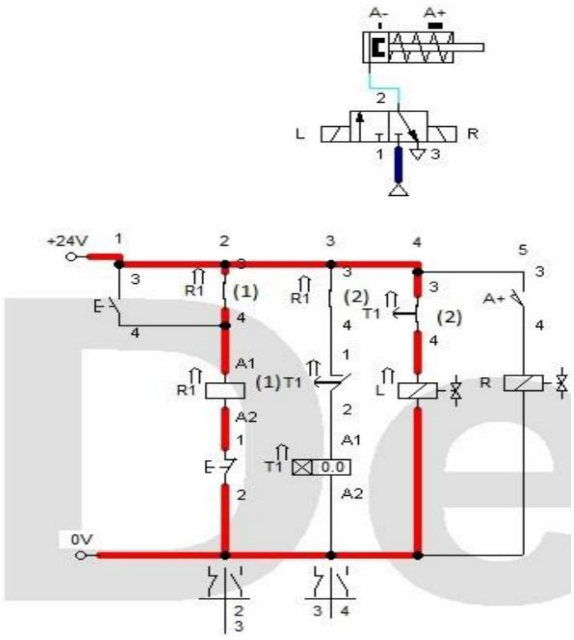

Fig.6 the compressor circuit at the zeroth second

Now as the position of the piston reaches to the A+ actuator control, the actuator switch in the circuit is turned ON which actuates the actuator R. Due to this, the position of valve changes to the terminator which drives out the air and the piston returns to A- position. This process happens automatically when the piston reaches to the A+ actuator control and it is independent of the on-delay timer (T1). Again on-delay timer comes back to its delay time and the timer starts again. This process continues for every particular delay of time in the timer.

D. Detection of garbage level

The maximum level of the garbage in the dustbin that can be compressed by a single directional cylinder is known as the threshold level of the dustbin. When the dustbin is dumped with garbage more than the threshold level, a part of garbage tries to escape through the hole in the plate but the hole is blocked by the leaf switch. Thus the garbage presses the leaf switch which is connected to the Arduino Uno board that can operate only for the maximum range of 200 meters. This Arduino receiver after receiving the frequency signal causes the LED to glow which is used as the intimation that the dustbin needs immediate cleaning. For large number of dustbins which are placed at different locations, it is implemented using a band of frequencies which is handled using RF transreceiver modules and advanced microcontrollers. Here each of the dustbins is allotted with different frequencies in a band. The transmission frequency is modulated with an intermediate frequency which is demodulated at the receiver. This change in the state of leaf switch causes the Arduino transmitter module which is connected to the Arduino Uno board to transmit a frequency of 315MHz, which is received by the Arduino receiver module which is also connected to Arduino Uno

E. Locating the transmitted dustbin in the central hub

The central hub consists of the city map that contains different LEDs saying the locations of corresponding smart dustbins which are installed. Thus the frequency transmitted by a dustbin's microcontroller and the glowing of the respective LED. denotes the particular dustbin's location in the city map. Thus the cleaning of that particular dustbin can be done effectively in the appropriate period of time preventing the accumulation of garbage.

CONCLUSION

The complete design of the dustbin is given, the circuit for the automation of compressor is successfully simulated and the desired results are obtained. The process to intimate the central hub that the dustbin is

full, it is discussed using Arduino Uno. Various features such as durability, affordability, prevention against damage and maintenance issues is kept in mind while designing the dustbin. Implementation these Smart Dustbins can prevent the accumulation of the garbage along the roadside to a great extent thereby controlling the widespread of many diseases. It can prevent pollution and alsoprevent the consumption of the spread out garbage by the street animals. This Smart Dustbin can contribute a lot towards a clean and hygienic environment in building a smart city.

REFERENCE

[1] L.Gogoi: (2012): Solid Waste Disposal and its Health Implications in Guwahati City: A Study in Medical Geography, Lambert Academic Publishing, Germany, ISBN 978-3-8454-0149-2.

[2] www.who.int

[3] swmindia.blogspot.in

★★★