Proceedings of the International Conference on Intelligent Computing and Control Systems (ICICCS 2019)
IEEE Xplore Part Number: CFP19K34-ART; ISBN: 978-1-5386-8113-8

Voice Controlled Automatic Dustbin with Garbage Level Sensing

Abhishek Ayush, Abhishek Kumar, Aditi Jha, Nilotpal Sarkar, Suresh Chandra Moharana and Himansu Das
School of Computer Engineering
KIIT Deemed to be University, Bhubaneswar, Odisha, India

abhishek2ayush@gmail.com, abhishekraj.ar718@gmail.com, aditijha1102@gmail.com, sarkarnilotpal3@gmail.com, sureshmoharana@gmail.com, das.himansu2007@gmail.com

***Abstract*— Voice Controlled Automatic Dustbin (VCAD) is a robotic dustbin that is controlled by providing specific voice commands by the user. The speech is received by the microphone of the android device and is processed by the voice module. When the instruction is recognized by the robot, then voice module sends a command message to the robot's micro-controller. The micro-controller analyses the message and takes appropriate actions. When garbage is detected by the sensor on the dustbin, it sends a command message to the dustbin's micro-controller. The micro-controller analyses the message and sends the command to the servo motor to opens the lid of the dustbin. The objective of this paper is to design a mobile dustbin which is controlled through a smart-phone that seeks for serving the old age and incapable people.**

Keywords*— *IOT, Smart Garbage Management, Arduino based system, Voice controlled automatic dustbin, Garbage Level Sensing

I. INTRODUCTION

Currently, the waste management[1] is quite a challenging issue in a country like India. "Smart Trash bin"[2] aims to resolve the problem related to waste management. The aim of the paper is to develop an affordable smart trash bin which will play a major role in cleanliness of the upcoming vision of smart cities. The major requirement of a smart lifestyle begins with the cleanliness and this cleanliness starts with dustbin. A society will get its efficient disposal of waste only if the dustbins are placed well and the garbage is collected in an organized manner. Garbage may consist of anything unwanted which may be generated from household, society, college, offices etc. Due to these wastes there will be emission of poisonous gases from it which is harmful for the nearby residents that may lead to severe diseases.

The ever increasing standards of life has made effective disposal of solid waste[1] more difficult with rapid urbanization and the ever increasing population growth. If we talk about waste collection and management the traditional system consists of human involvement in disposing off the trash and the ordinary ever so over flooded dustbins placed across the city by the various Municipal Corporations. In order to reduce environmental pollution, we need to focus on a proper and efficient waste collection system and the VCAD seeks to serve just that purpose. Generally, people are not finding themselves responsible to use the traditional dustbins which in turn leads to garbage being thrown outside the dustbin. Also the placement of dustbins is a major issue, due to its immobility of the traditional dustbin that need to be placed at a certain interval. This increases the number of dustbins for which the cost increases and effectiveness decreases. To address this issue, VCAD is developed to bring down the cost of garbage collection system and enhance the effectiveness.

The organization of the rest of the paper is as follows. The detailed working model of VCAD is described in Section 2. Section 3 presents the results of the proposed VCAD model, the applications of this model is described in Section 4. Finally, Section 5 concludes the work described in the paper.

II. WORKING MODEL OF VCAD

In this paper, the working model of VCAD is categorized into two sections: the robotics section and the waste disposal system as shown in Fig. 1 and Fig. 2 respectively. The detailed working model of the VCAD is presented in Fig. 3. This model includes bluetooth device, 'Arduino uno'[3], motors driver, and DC motors. The working model of VCAD can be connected easily via Bluetooth[3] by simply downloading an Android app called "Android Bluetooth Controller" from the Google play store. After successful installation of the app, we search for the robot nearby to pair up. Once the pairing is done, we can simply send our voice commands to the VCAD. Apart from the voice commands, we can also send instructions to the robot via the graphical user interface (GUI) input system and the character user interface (CUI) input system. The basic commands such as Forward , Backward , Left , Right and Stop (as shown in Fig. 1) that the robot is programmed to work.

Now for disposing off the waste, when the dustbin has arrived close to human being, we simply need to place the trash in our hands in front of the Ultrasonic Sensor[4] placed in the dustbin. The sensor detects the trash and instructs the servo motor for automatic opening and closing of lid. The lid opens after the trash is detected and that trash can easily be thrown inside the dustbin. Once the trash is thrown into the dustbin, after a certain time interval the lid of the dustbin automatically closes itself. When the level of the trash inside the dustbin increases up to half of the depth of dustbin, the Green LED glows up. When the level of trash in the dustbin again increases up to the brim, the Red LED goes up, indicating that it's time for the dustbin to be emptied (as shown in Fig. 2).

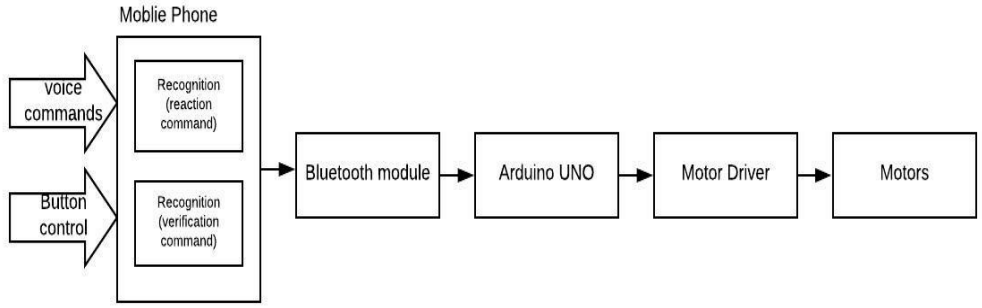

Figure 1: Block diagram of Robot

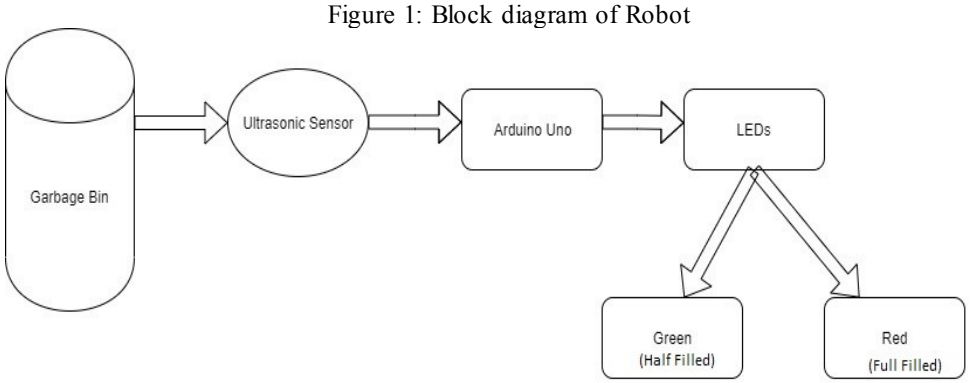

Figure 2: Block diagram of Dustbin

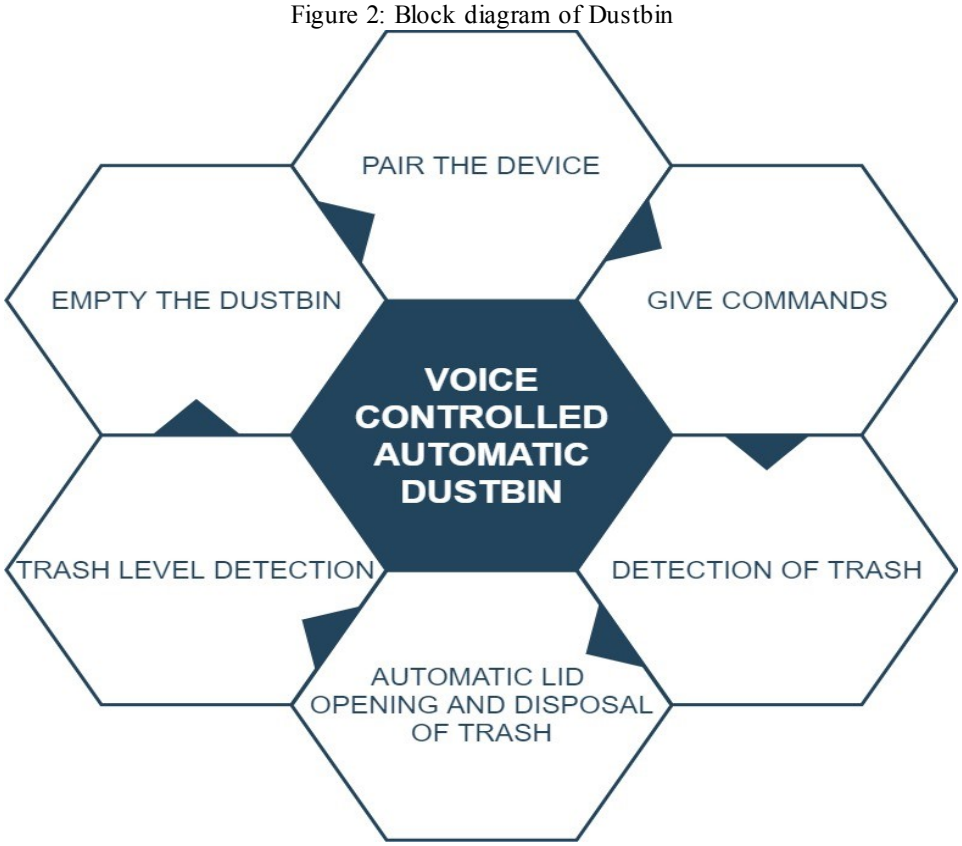

Figure 3: Working model of proposed VCAD

III. RESULTS

The LED and ultrasonic sensor are connected to the micro-controller [5] (as shown in Fig. 4) which serve the purpose of detection of garbage level[6] of the dustbin. The two level of the dustbin (i.e. half filled and full filled) was calculated by measuring the depth of the dustbin. The entire depth of the dustbin was around 26 centimetres (cm), and the half filled level was programmed to trigger the green LED when the garbage level reached to 13 cm that is half the capacity of the dustbin (as shown in Fig. 5).The red LED was triggered, when the garbage level in the dustbin was observed to be greater then 23 cm (as shown in Fig. 6).

The commands to the dustbin can be given by three modes such as the voice commands, CUI input and the GUI input which makes sure that each and every individual is able to use it. The voice control commands[7] are left, right, forward, backward and stop. The aforesaid commands move the robot in left, right, forward and backward directions respectively (as shown in Fig. 7, Fig. 8, Fig. 9 and Fig. 10). The commands for the terminal based input are same as above and for the console based input there is a designed console in the app using which we can control the robot similar to the way in which we control a gaming character.

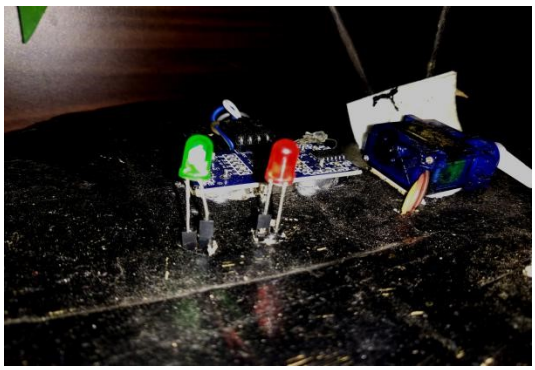

Figure 4: Led Indication Of Garbage Level

Figure 5: Half Filled Dustbin

Figure 6: The Dustbin is Fully Filled

Figure 7: When The Dustbin Moves Left

Figure 8: When The Dustbin Moves Right

Figure 9: When The Dustbin Moves Forward

Figure 10: When The Dustbin Moves Backward

IV. APPLICATIONS IN HEALTHCARE

This model can be useful in hospitals, for the patients who are advised bed-rest and they are not able to move. Then in that case the patient can call the dustbin towards him by giving the instructions such as left, right, forward and backward. The VCAD will come towards the patient and the lid will open automatically once the garbage is shown to the sensor. Then the patient can throw the garbage inside it. In other way, if the patient wants to vomit and is not able to move then in that case the smart dustbin will come towards the patient. Apart from this, the automatic opening of lid is also helpful for the doctors for hygienic environment. In this scenario, if the doctor wants to throw the medical wastes such as cottons, syringes into the dustbin, in that case the dustbin will open the lid without touching the dustbin and thus making it more convenient way of disposal of medical wastes. Apart from this, this application can be put in the cloud environment [8-18] and each and every user can remotely access this application and get benefit out of it.

V. CONCLUSION

The above working model (i.e. VCAD) is a primary step towards the Swachh Bharat Abhiyan by the government of India. It thus emphasizes on the feasibility of the prototype to be put into mass production pertaining to its simplicity in design and low production cost. The Smart Dustbin aims to improve the garbage collection system and its disposal at appropriate time across the country. The features of VCAD include automatic lid opening, garbage level sensing, and dynamic mobility will marginally reduce the human efforts required to collect the garbage in comparison to the conventional methods. There are still some shortcomings such as the problem of foul odour, manual control which restricts the mobility of the dustbin which can be addressed into the future versions of the dustbin. In future, realizing the requirement of an autonomous dustbin, GPS module can be implemented for path finding. The robot can be upgraded to connect more number of people in public places and the motor can be enhanced for better performance in terms of speed and durability. A charging port can also be provided for recharging the battery after its exhaustion.

References

[1] Vasagade, T. S., Tamboli, S. S., & Shinde, A. D. (2017, March). Dynamic solid waste collection and management system based on sensors, elevator and GSM. In 2017 International Conference on Inventive Communication and Computational Technologies (ICICCT) (pp. 263-267). IEEE.

[2] Krueger, R. (2007). Making 'smart'use of a sewer in Worcester, Massachusetts: a cautionary note on smart growth as an economic development policy. Local Environment, 12(2), 93-110.

[3] Kannan, K., & Selvakumar, D. J. (2015). Arduino based voice controlled robot. International Research Journal of Engineering and Technology (IRJET), 2(01), 49-55.

[4] Chaware, S. M., Dighe, S., Joshi, A., Bajare, N., & Korke, R. (2017). Smart garbage monitoring system using Internet of Things (IoT). Ijireeice, 5(1), 74-77.

[5] Bala, A., Kumar, A., & Birla, N. (2010). Voice command recognition system based on MFCC and DTW. International Journal of Engineering Science and Technology, 2(12), 7335-7342.

[6] Medvedev, A., Fedchenkov, P., Zaslavsky, A., Anagnostopoulos, T., & Khoruzhnikov, S. (2015, August). Waste management as an IoT-enabled service in smart cities. In Conference on smart spaces (pp. 104-115). Springer, Cham.

[7] Nishimori, M., Saitoh, T., & Konishi, R. (2007, September). Voice controlled intelligent wheelchair. In SICE Annual Conference 2007 (pp. 336-340). IEEE.

[8] Mishra, B. S. P., Das, H., Dehuri, S., & Jagadev, A. K. (2018). Cloud Computing for Optimization: Foundations, Applications, and Challenges (Vol. 39). Springer.

[9] Pattnaik, P. K., Rautaray, S. S., Das, H., & Nayak, J. (Eds.). (2018). Progress in Computing, Analytics and Networking: Proceedings of ICCAN 2017 (Vol. 710). Springer.

[10] Panigrahi, C. R., Tiwary, M., Pati, B., & Das, H. (2016). Big Data and Cyber Foraging: Future Scope and Challenges. In Techniques and Environments for Big Data Analysis (pp. 75-100). Springer, Cham.

[11] Das, H, Barik, R.K., Dubey, H., Roy, D.S., Cloud Computing for Geospatial Big Data Analytics: Intelligent Edge, Fog and Mist Computing. Springer.

[12] Reddy, K. H. K., Das, H., & Roy, D. S. (2017). A Data Aware Scheme for Scheduling Big-Data Applications with SAVANNA Hadoop. Futures of Network, CRC Press.

[13] Das, H., Jena, A. K., Badajena, J. C., Pradhan, C., & Barik, R. K. (2018). Resource Allocation in Cooperative Cloud Environments. In Progress in Computing, Analytics and Networking (pp. 825-841). Springer, Singapore.

[14] Sarkhel, P., Das, H., & Vashishtha, L. K. (2017). Task-Scheduling Algorithms in Cloud Environment. In Computational Intelligence in Data Mining (pp. 553-562). Springer, Singapore.

[15] Kar, I., Parida, R. R., & Das, H. (2016, March). Energy aware scheduling using genetic algorithm in cloud data centers. In Electrical, Electronics, and Optimization Techniques (ICEEOT), International Conference on (pp. 3545-3550). IEEE.

[16] Panigrahi, C. R., Tiwary, M., Pati, B., & Das, H. (2016). Big Data and Cyber Foraging: Future Scope and Challenges. In Techniques and Environments for Big Data Analysis (pp. 75-100). Springer, Cham.

[17] Kar, I., H Das, "Energy Aware Task Scheduling Using Genetic Algorithm in Cloud Datacentres", International Journal of Computer Science and Information Technology Research, Vol. 4, Issue 1, 2016, pp: 106-111

[18] Sahoo, AK., H Das, "Energy Efficient Scheduling Using DVFS Technique in Cloud Datacenters", International Journal of Computer Science and Information Technology Research, Vol. 4, Issue 1, 2016, pp: 59-66