ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 6, June 2018

Microcontroller Based Automated Garbage Level Detection And Segregation

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Abstract- **Garbage and waste disposal is a huge problem that affects India. Disposing of waste has huge environmental impacts and can cause serious problems. Waste disposal has been a problem in India for a few years, yet the problem hasn't been solved. When the waste starts to accumulate due to increasing population, the garbage ends up in landfills, rivers, oceans, which liberates harmful toxins that affect the entire ecosystem. One of the possible solutions is to segregate the waste at the disposal level itself and use the segregated waste for various purposes like to generate energy, use them as manure. In our country the collection, transportation and disposal are disorganized and chaotic. Developing a mechanized system to make our world a cleaner and greener place is our main objective. Thus, we have proposed a system to detect the level of garbage and segregate the waste into mainly two categories wet and dry. The wet waste is then converted into manure. We have proposed a system to give back to our mother earth and do our bit to protect the environment and make our country a cleaner place to live in.**

Index Terms— Automation, smart bin, waste segregation, moisture sensing, composting.

I.INTRODUCTION

In today's time garbage disposal has become a huge cause for concern in the world. The rising population poses a serious threat to the amount of waste deposited every day. India produces 62m tonnes of urban waste annually, out of which 7.90m tonnes consists of hazardous waste, 5.6m tonnes is plastic waste, 0.17m consists of biomedical waste and 15 lakh ton is e-waste. The total waste generation is estimated to increase to about 165 million tonnes by 2030 due to overflowing landfills as shown in Fig. 1. India has become a home to major toxins and greenhouse gases. The problem is how to integrate the technology with a system of segregation so that waste does not end up in landfills but is processed and reused. It is clear that if the waste is not segregated there will be no value from waste as energy or material. In India, Rag pickers play a very important role in recycling waste. Rag pickers are extremely prone to skin infections, allergic disorders and respiratory diseases in addition to dog bites and other vermins. Therefore, it is better to segregate the waste at domestic or municipal level itself. The situation calls for an efficient system to sort waste at primary level and make waste management more organized and systematic. Hence, we have come up with an automatic waste segregator which segregates waste into two categories, namely, wet and dry [1]. The method adopted in this paper is to dispose the waste before it accumulates by detecting its level, segregate the waste with less cost and composting the wet waste. This can be implemented in the domestic level as well.

Fig. 1 Improper management of waste disposal in a college in Bangalore

II. METHODOLOGY

A. Level detection

The initial stage of this paper is a smart bin that detects the level of the waste in a garbage bin with the help of an ultrasonic sensor that is interfaced using NodeMcu (ESP8266) [2] as shown in Fig. 2.

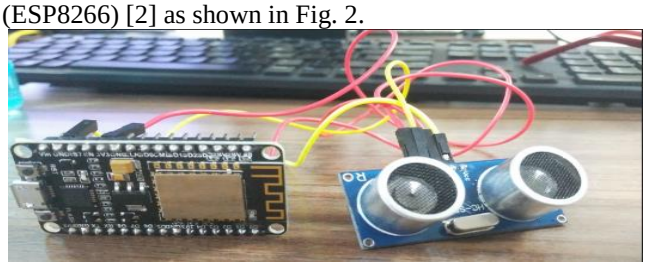

Fig. 2 Automated level detection using ultrasonic sensor and NodeMcu.

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The ultrasonic sensor sends out a high frequency signal pulse through trigger pin. This pulse is reflected back to the sensor when it comes in contact with an object and is intercepted by the echo pin. The sensor then calculates the distance between the object and itself based on the time that is taken by the pulse to emit and reflect back to the sensor. The resulting distance is thus the key factor based on which this stage of the paper is built. To detect if the waste accumulates over a certain threshold level of about 75% is set. NodeMcu has an inbuilt Wi-Fi module of as shown in Fig.3. Through this Wi-Fi module an alert message is sent over cloud to the garbage collector when the waste crosses the specified threshold limit. Ubidots provides a platform to enable this. The data from the ultrasonic sensor is thus sent to cloud through Ubidots. This data is then forwarded to the respective garbage collector in the form of an alert message. Based on this message the garbage collector collects the waste.

B. Waste Segregation

The second part is the segregation of waste which is the most crucial step that has to be taken in order to make the environment clean and green. In this paper the waste is segregated into two categories namely wet and dry [3]. This step is implemented using a moisture sensor and IR sensor module [4]. These sensors are interfaced using Arduino Uno [5].Figure 4 represents the model that has been implemented in this paper.

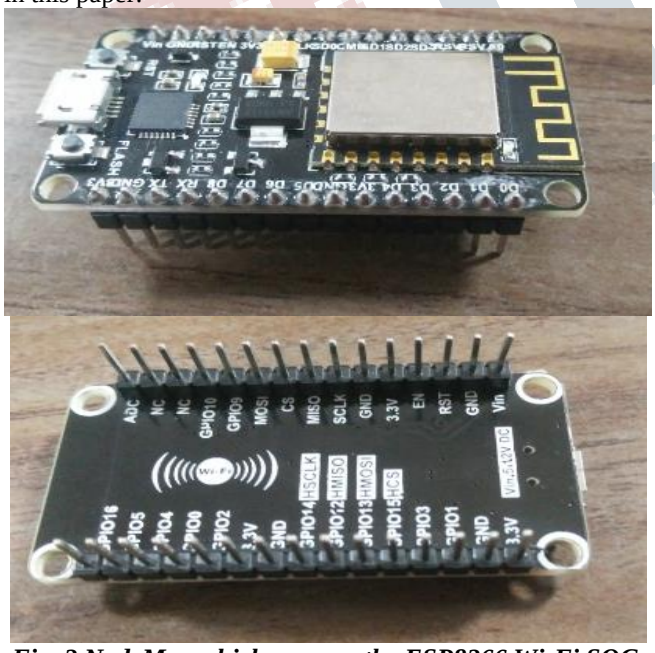

Fig. 3 NodeMcu which runs on the ESP8266 Wi-Fi SOC.

When the garbage is dropped into the bin it falls on the horizontal movable plate which contains a moisture sensor and an IR sensing module. The IR (infrared) sensor is used to activate the segregation system based on whether the garbage has been dropped into the bin or not. The IR sensor thus detects the presence of garbage on the horizontal plate. It does so by transmitting an infrared signal from the IR transmitter. This signal bounces back to the sensor when it comes in contact with an object and is received by the IR receiver. If the IR sensor detects the presence of garbage then the moisture sensor is activated. The moisture sensor uses capacitance to measure the dielectric permittivity of the waste. The dielectric permittivity is a function of the water content. The moisture sensor produces a voltage which is proportional to dielectric permittivity which in turn is proportional to water content. Thus it detects the content of moisture in the waste. Based on the resulting moisture content the sensor decides whether the waste is wet or dry. The movement of the horizontal plate on which the waste falls is controlled by using a servo motor (sg 90) based on the output of the moisture sensor. The servo motor is programmed in such a way that it rotates the horizontal plate either in clockwise (900) or anticlockwise (900) direction. If the waste is detected to be wet then the plate rotates by an angle of 900 in the clockwise direction. If the waste is dry then the plate rotates by an angle of 900in the anticlockwise direction. Once the plate rotates in the desired direction the waste falls into the respective bin.

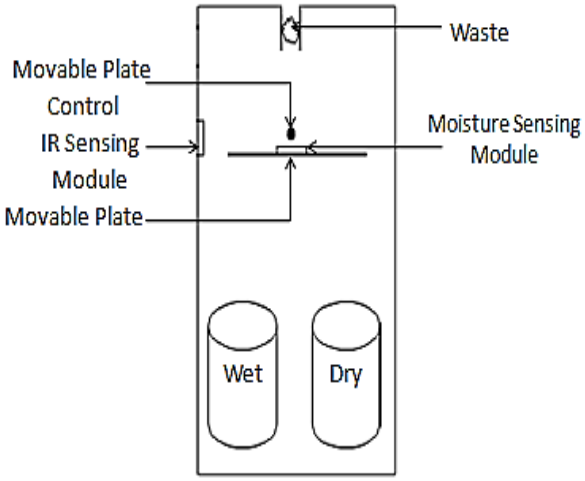

Fig. 4 Microcontroller based automated waste segregator.

C. Best from Waste (composting and recycling)

The segregated waste obtained from the section B is used for various applications such as composting and recycling [6]. The wet waste is converted into manure naturally or by using chemicals. If composting is done naturally with the help of microorganisms, organic manure is obtained which takes about 30-45 days. Whereas, it takes about 24-48 hours to obtain manure if composting is done with the help of

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chemicals. This helps in reducing pollution and also helps in reducing the emission of greenhouse gases. It mainly reduces energy usage. Thus, it helps in conserving natural resources and reducing global warming, air and water pollution.

Fig. 5 Arduino Uno microcontroller board.

III. CONCLUSIONS

Automated waste level detection and waste segregation has been implemented at domestic level. The automated waste level detector detects the level of the waste in the garbage bin and informs the garbage collector that the bin is full through cloud. The automated waste segregator segregates the waste into wet, dry, and plastic. This segregated waste is converted into manure or recycled for further use. The model mentioned in this paper has thus been tested and implemented successfully.

IV. ACKNOWLEDGMENT

The authors would like to acknowledge Dean Dr.A. Srinivas, Dayananda Sagar University, Bangalore for his valuable guidance. They would like to thank Dr. Vaibhav A.M, Head, Department of Electronics and Communication Engineering for their co-operation and support.

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