Design of IoT based Garbage Segregation for Automatic Smart Trash Bin using NI LabVIEW

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Abstract*: *A Smart Trash Bin segregates wastes by itself as degradable wastes and non-degradable wastes with the help of sensors and motors, interfaced with NI myRIO. Rapid changes in technology, low initial cost and planned obsolescence have resulted in a fast-growing surplus of wastes all around the globe. People dump wastes on roadsides, which is not picked up regularly by the people responsible. It s proposed to separate the wastes into categories like degradable and non-degradable will take place in an effectively closed manner .The entire process of waste input, level and segregation is monitored and controlled by the reconfigurable IO using sensors , thereby reducing the open decomposition of organic wastes, thus curbing the growth of micro organisms.

Keywords* : *Smart trash bin, Automatic, wireless,NI my RIO, waste segregation, epidemics, management, recycling. motor-driver.

I. INTRODUCTION

In most of the places in India, garbage is dumped as one, mixing degradable and non-degradable wastes, causing the spread of a lot of epidemics. In our daily life, we see the garbage bins being overfull and all the garbage spills out resulting in pollution. Due to population growth, industrialization, and economic growth, a trend. of significant increase in Municipal Solid Waste (MSW) generation has been recorded worldwide. In India, the total generated waste is expected to cross 800,000 tons in **2012**. This figure is expected to grow at a rate of 30 – 50 % every year. With correspondence to the *Swachh Bharath* Scheme of our Honourable Prime Minister to make India clean and green, this automatic waste sorting trash bin is an initiative taken **by us** to make it more commendable. While the existing bins and prototypes that separate wastes, there are none in use in domestic and industrial environments. The current smart trash bins just segregate wastes that are metallic and non-metallic, or wood, paper and plastic. In this paper, an automated smart trash bin prototype is implemented with the effective garbage segregation in closed manner and avoids the unnecessary spread of microorganisms.

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II. METHODOLOGY

The automation of the smart dustbin is achieved through the use of a power supply, MYRIO, APR module, PIR sensor, servo motor, and ultrasonic sensor all programmed using LabVIEW . In addition, DC motor and IR sensor and stepper motor are used .A block diagram of the control circuit is shown in Figure 1. The automatic smart trash bin receives the wastes and segregates them with the help of ultrasonic, infrared and proximity sensors. By using a conveyor belt, the trash is moved forward along the path of the above mentioned sensors. The sensed wastes are pushed out into small designated bins for metal, plastic (non-degradable), and paper and vegetable peels (degradable). Water is initially used to wash and separate the dust from the garbage. The water with the residue dust is led out to the plants as a means to water them. The level of water is sensed and filled automatically, with a water level sensor, or it can be done manually. The bio-degradable wastes (paper and vegetable wastes) ar e mixed to generate small manure for kitchen gardens. This smart trash bin is suitable for both home and a general office setting.

III. PROPOSED SYSTEM

When a person with intent to dump wastes into the smart bin nears at 30cm from the bin, the **IR Sensor** would initiate the lid of the bin to open. When the wastes are being dumped, the **Ultrasonic Sensor** present near the mouth of the bin detects its descent and starts the entire setup. The wastes fall onto the **mesh** in the bin, which is present halfway down the water level; the bin is three-quarters filled with water. The **motors** attached to the mesh cause the movement of it in a to-and-fro pattern, for a total of 5 rotations. Then, one motor stops and the other's working will tilt the mesh towards the **rubber conveyor belt**. The speed of the conveyor belt is slightly larger than the speed of the motor.As the waste gets dumped on to the conveyor belt, if any of the wastes is metallic in nature, it gets sensed by the **Metallic Sensor**,and gets pushed into the corresponding bin by a **fibre arm**. The rest of the wastes are moved forward along the belt. If the wastes have plastic, it gets sensed by the **Plastic Sensor**, and the fibre arm pushes it into the corresponding bin. The rest of the wastes are paper and vegetable peel, which are degradable wastes. If any of the smaller bins are full, the ultrasonic sensor will detect its presence for more than 10 seconds. Then, the **LCD Display** on the main bin will display "BIN FULL" and the entire system is stopped until the waste is cleared. The water present in the big bin is monitored by a **water level indicator**.

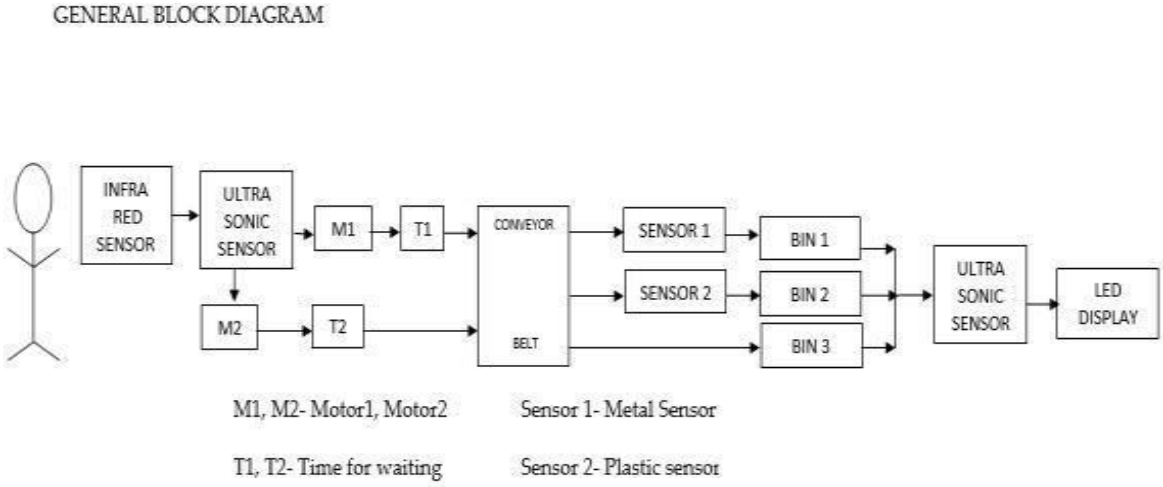


Fig. 1 Block diagram for the control circuit of smart trash bin

The water present in the big bin is monitored by a **water level indicator**. If the water gets below the level, then water is automatically filled in, and the water out is connected to the nearby backyard or kitchen garden as a method of drip irrigation.

IV. OVERALL DESIGN

The smart dustbin consists of different sections for all kinds of waste disposal which includes:

1. Plastic Waste
2. Metal Waste
3. Liquid Waste
4. Paper waste
5. Organic wastes.

The individual will throw waste in the bin. The waste once thrown will go to a large container attached with the dustbin that segregates the waste accordingly.

HARDWARE SPECIFICATIONS:

Sensor for Garbage Segregation

In this segment various types of sensors used for effective functioning of garbage segregation is reviewed. Sensors are the basic components of the Automatic smart trash bin system in which it is used for detecting human, sense the presences of waste, sense and segregate the waste. The expeditious evolution of integrated circuits and other technologies in same stream has increased the usage of smart sensors to provide fast and accurate results with less amount of energy preservation. The AK970 IR sensor is utilized for the purpose of human detection. The operating voltage of this sensor is in the range of 1.71V to 3.63V. Human detection within the range of 5-12m can be done by these passive Infrared sensors. The second main sensor established for the purpose to sense the presence of waste in a running system is ultrasonic sensor. This ultrasonic sensor measure the distance of garbage by transmitting a sound pulse and the time delay received back received back as echo signal . Following the ultrasonic sensor the conveyor belt is used to move the waste across the metal and plastic sensors slowly and initiate the segregation process. In metal sensor electromagnetic waves are generated with high frequency and high ringing voltage. The coil becomes detuned when a metal is sensed; this in turn reduces the segregated. Following metallic sensor, plastic sensors are used to separate plastic from paper and vegetable peel. The main working principle of a plastic sensor is obtained by varying the capacitive voltage between the pairs of plates by varying the dielectric medium. Thus plastic sensor completes the work of segregating biodegradable and non-biodegradable waste and vegetable peel.. MyRIO is used as the platform to code the sensors and motors into automation.

MyRIO

Fig.2 MyRIO

IR sensor output is acquired by myRIO. It is an I/O processor with dual core of ARM and FPGA. To implement the multiple device control through this reconfigurable device with MXP /MSP connectors. Hence the control operations is performed by Programming in MYRIO using LabVIEW. GSM module is interfaced for wireless communication. WiFi module is enabled for remote control and embedded application. Here, MyRIO is used as the platform to code the sensors and the motors into automation.

V. WORKING MECHANISM

The process of garbage segregation is implemented in three ways , based on the type and condition of the waste, recycling process may be recommended for the effective sorting system. This system depends on proximity sensors for the presence of the object in the system and plastic material sensor. The plastic sensor identifies the levels of plastic based on the resonant frequency of every material of plastic. The molecules of the different plastic material are excited by tuning laser diodes for various resonant frequencies of the plastic and are thus detected.

With the combination of proximity sensors and plastic sensors, the wastes get separated based on their degradability. This gives us the choice of disposing the non-degradable wastes as recyclable and degradable as manure for plants. This is also considerably affordable and stable, it also reduces the spreading of germs via garbage because the water is recycled to plants regularly and the setup is closed. Once any of the small bin is full, the larger bin won't open until the waste is cleared, thus ensuring no overflow of garbage . The Challenges faced is that the setup is bigger than the usual trash bins and the implementation of all the sensors and motors connected to a single myRIO.

Benefits

Waste compression can reduce the environmental pollution. The main advantage is transforming waste into treasure through recycling. Compression reduces the consumption of land resources. The automation circuit setup is simulated and produce the operation results . The successful execution for implementing the automated smart dustbins can avoid the accumulation of the garbage in the roadside and thereby curbing the formation of microorganisms which inturn avoid the diseases. Pollution can be prevented and avoid the steet animals for the consumption of garbage .

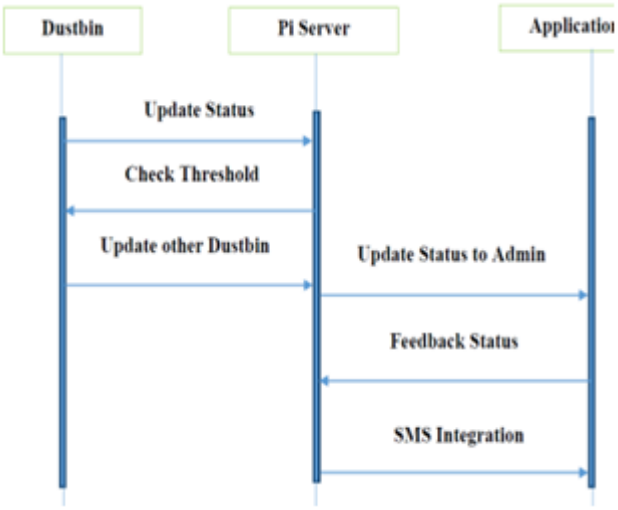


Fig.3 Sequence Diagram

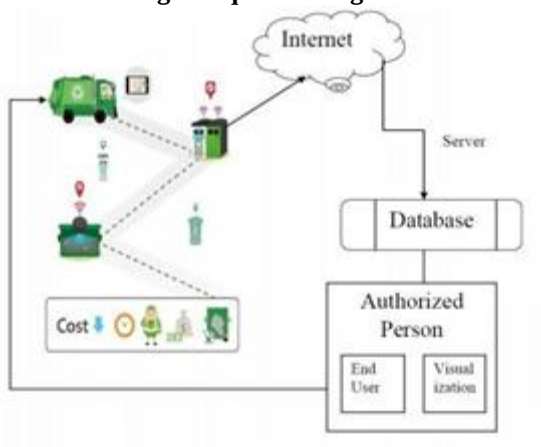


Fig.2 System Architecture

***Bin 2*:** For dumping plastic wastes.
***Bin 3*:** For dumping paper and vegetable peel (degradable wastes).

The bins are fitted with Ultrasonic sensors that sense the level of wastes in the bin. Once a bin is filled up, an LCD display shows "FULL BIN" and stops the setup from running again till the waste is disposed of.

WI-FI MODEM: allows to be integrated with sensors and GPIOs through onboard processing of input signals. This on chip integration includes minimum external circuit and designed with pcb. Its high degree of on-chip integration allows for minimal external circuitry, including the frontend module, is designed to occupy minimal PCB area. The ESP8266 Wi-Fi Module is a self-contained SOC with combined TCP/IP decorum stack that can give RIO processor access to your Wi-Fi network. The ESP8266 is supporting and all wifi networking functions functions from another application processor. Each ESP8266 Module is pre-programmed using LabVIEW programming. The ESP8266 wifi module is a cost effective board The properties of ESP8266 I to renovate this module in. to IoT solution . ESP8266 module is work for external logic level converter.

System Architecture

The IOT Garbage Monitoring system is a very innovative system which will help to keep the cities clean. Thus this scheme aids to remain the city spotless by updating about the trash levels of the bins by providing graphical representation of the bins via a web page. This arrangement monitors the garbage level in the bins and identifies the garbage level collected through web page.

The ultrasonic sensors positioned to detect the bins and garbage level related to depth of the bins. The mechanism is controlled by the MYRIO processor and display the mechanism in LCD module and data transmission is operated by WIfi module. The process is powered with 12V supply. The web page presents the graphical view of the garbage bins and intimate the garbage collected in color to confirm with the severity of garbage disposal. In the smart dustbin IR sensors will continuously monitor the status of the bin. If the bin reaches more than certain level , the level sensors will respond and make effective clearance by communicating the concerned authority. The output of IR sensor is a digital output which is generally either "1" or "0". This output is given to the case structure. The case structure has two cases, a true case and a false case. The IR sensor is placed at the tip of the dust bin. When the IR sensor senses the garbage level it gives logic "1" then it goes to true case and the SMS will be sent to the concerned authorities. If the IR sensor does not senses the garbage level, it produces a logic "0" so that it goes into the false case. In this case, no SMS will be sent and the process repeats until the level of garbage is detected by the IR sensor.

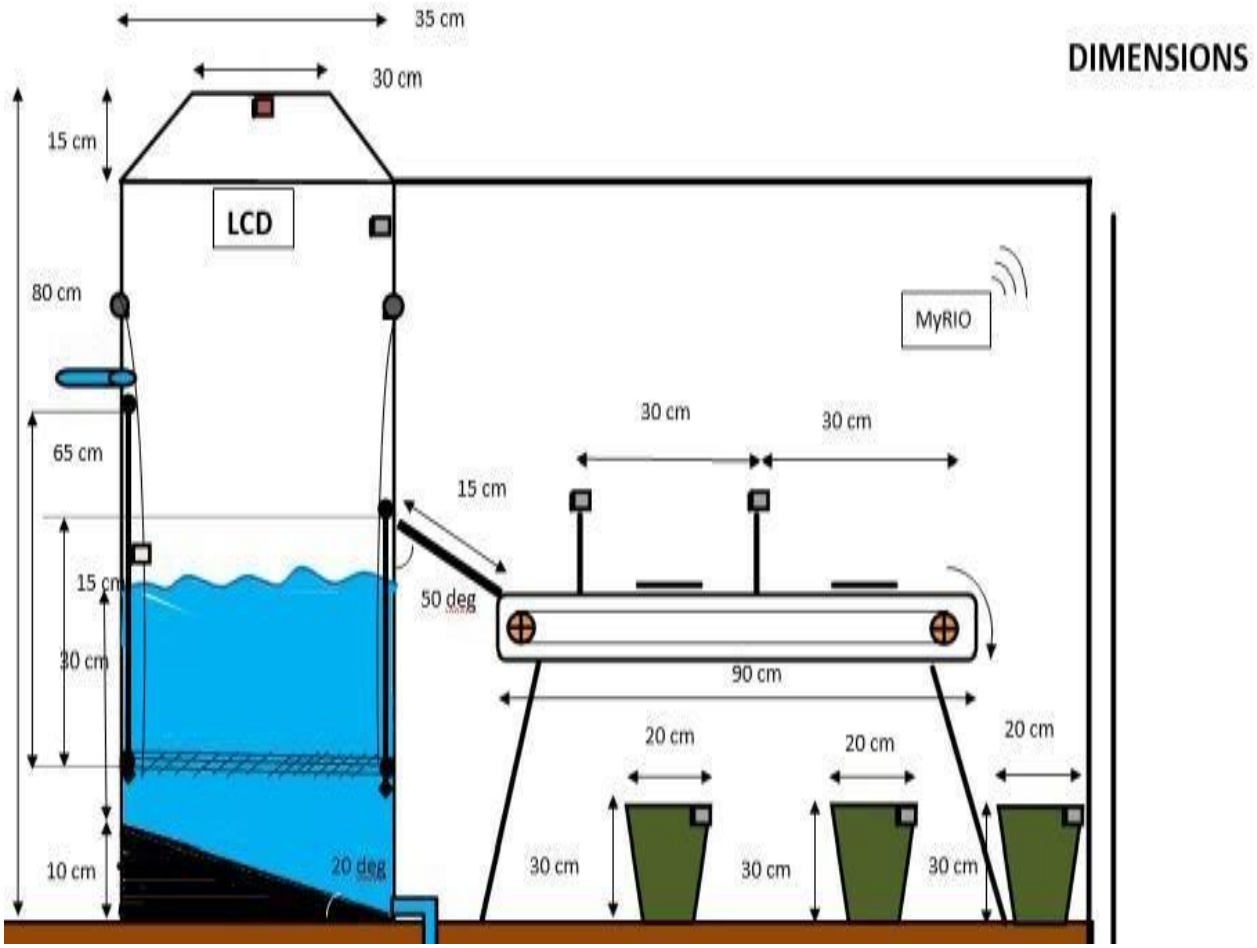


Fig.5 Block diagram of trash bin structure with dimensions

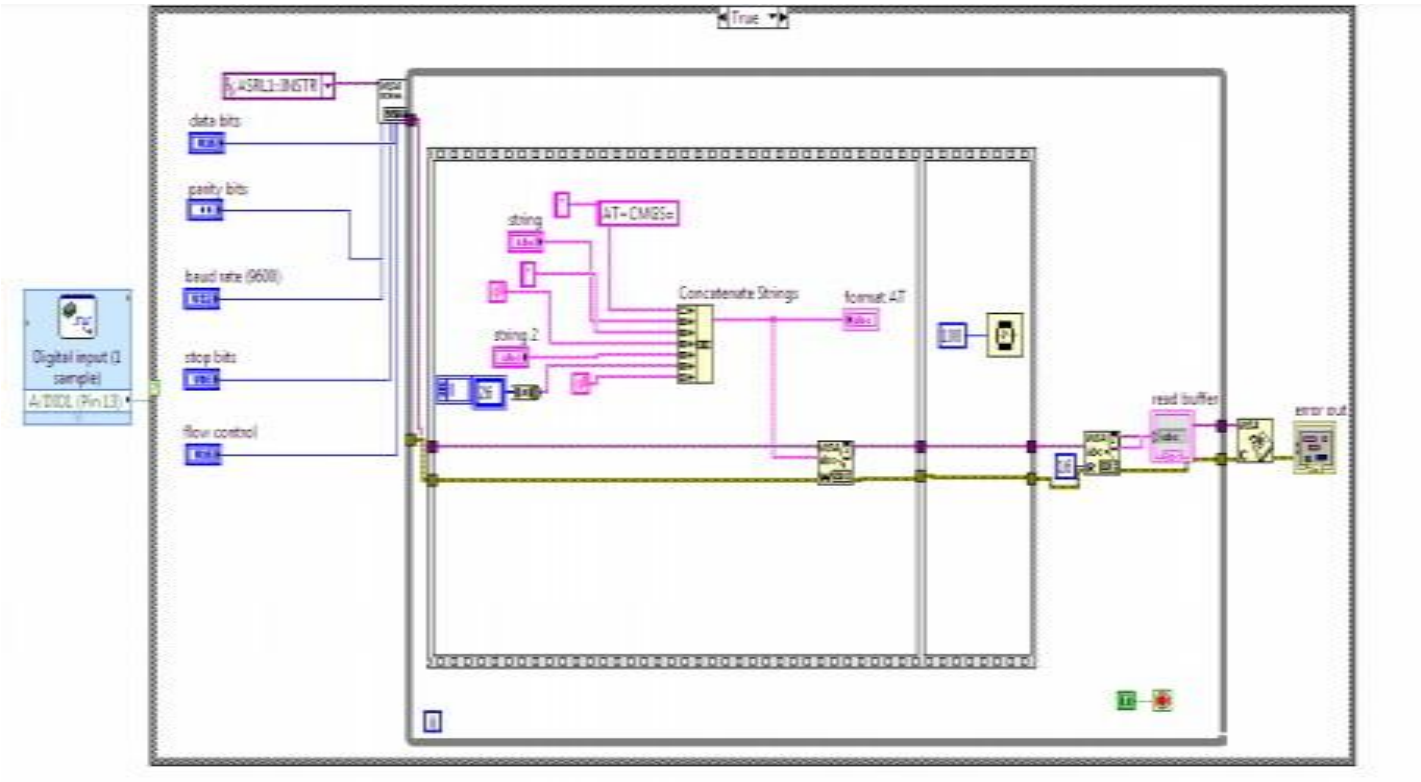
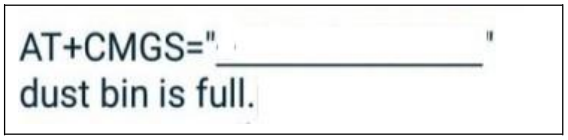


Fig.6 Block diagram implanted in LabVIEW

The SMS consists of AT command, number and the message. Here the display of AT command and the number are not required, but the message is essential. LCD .

Display Unit



VI. CONCLUSION

Automated garbage segregation is successfully implemented for the sorting out the wastes in to metals, plastic and vegetable peels. etc.. The entire sensing process for the segregation the waste is comtrolled and monitored by MY RIO in single platform for the effective operation . This method of implementation saves time in segregation by human and affordability in domestic applications. This Smart Dustbin prototype will contribute a lot to the society to provide a clean and hygienic environment. GSM module intimate the bin status to the concerned authority for continual clearing of waste. GPS module interface to the bin will update the location for the dump. The garbage collector receives message thorough GSM module and identifies the location for garbage collection and dumps it into a segregator. This would lessen the stray trash on the streets.

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