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Smart Hospital Dustbin

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***Abstract*: The nation and world is facing a huge problem in hospitals, segregation and recycling of biomedical waste, and improper management of these wastes are hazardous and dangerous to human health and ecological system. There is a rapid increase in capacity and categories of biomedical waste as a result of urbanization, constant economic growth. Global Waste Management Market reported that the amount of waste generated worldwide produced. "Biomedical Wastes are not always waste if it is segregated as it was". To properly manage the waste it has to be handled, segregated, transported and disposed so as to reduce the risks to the public lives and sustainable environmental. The economic value of waste is best comprehended when it is segregated. Currently there is no such system employed of segregation of glass, plastic and metallic wastes at hospitals level. Here we propose an automation of biomedical waste material Segregation in hospitals. This method is easy and simple solution of segregation of three types of wastes glass, metal and plastic. It is designed to sort the trash into metallic waste, plastic waste and glass waste ready to be processed separately for the next process of operation. The method uses inductive sensors for metallic items, and capacitive sensors to distinguish between and plastic and glass waste. Experimental results show that the segregation of waste into metallic, plastic and glass waste has been successfully implemented using the Automation of material segregation (AMS) method.**

***Keywords*: Inductive sensor, capacitive sensor, IR Sensor, Arduino Nano Microcontroller, Processing Software.**

1. Introduction

Biomedical waste is defined as any type of waste created during a diagnostic process, the treatment of a condition or disease, or immunizations of humans or animals. It also includes any research activities or processes that involve biological testing. In essence, it's any type of waste that contains any type of the material that may be contaminated with potentially infectious properties.

Infectious properties can be found in syringes delivering medications or chemotherapy. They can be found in bedding, bandages, or clothing contaminated with blood or bodily fluids of a person infected with a communicable disease. Healthcare waste management, including that of biomedical waste, is as important as disposal of that waste. The impact of biomedical waste on the environment should be the concern of every employee in every healthcare facility, regardless of size or location. That's why it's important to identify it and segregate it properly. When the biomedical waste is segregated into basic streams. The metallic waste could be reused or recycled. Even though there are big hospitals and govt. hospitals waste segregators present, it is always much better to segregate the waste at the source itself. The benefits of doing so are that a higher quality of the material is need for recycling which means that more value could be recovered from the waste. The occupational hazard for waste workers is reduced. Also, the segregated waste could be directly sent to the recycling and processing plant instead of sending it to the segregation plant then to the recycling plant. Currently there is no system of segregation of hazardous wastage. That a least cost, most appropriate technological option for safe management should be developed. The purpose of this project is the realization of a compact, low cost and user friendly segregation of biomedical waste system for hospitals.

2. Literature survey

Lots of the problem can be fenced if the Biomedical waste management is properly executed. The activities that are usually performed as part of health care waste management involve segregation, storage, collection, transportation and disposal of biomedical waste. It includes organizational, planning, administrative, financial, engineering aspects, legal, and human resource development and their management involves interdisciplinary relationships. Management of biomedical waste requires commitment at all the levels from healthcare providers. A system that is managed by irresponsible and untrained staff, the risks and the importance of their "contribution" is dreaded. Awareness regarding rules of disposal of biomedical waste needs to be taught even among qualified medical personnel, including hospital administrators, private and governmental institutes, hospitals and colleges. Knowledge regarding the significance of biomedical waste, its relationship with the ecosystem, the environmental toxins used in health care industry and the impact of callousness on public health, remain very minimal. For better result we need to increase the level of training and education regarding biomedical waste and environment-friendly health care with optimum priority, under rules and legislation.

In [1], As the production and consumption is proliferating, extensive amount of solid materials are generated as well as rejected by people on regular basis. Garbage mountains are a

commonly seen today. The waste dumped is ubiquitary in the form of rotting mound that dot our terrains and make our rivers, wells, lakes abhorrent. 68.8 million tons municipal solid waste is generated per year in India Unsorted waste, when collected, is dumped openly that leads to generation of leachate and gaseous emissions contaminating the nearby environment.

In [2], Technology always help mankind in making life easier. Now presenting an innovative way which revolutionize the trash management system through this we are taking a step towards clean India. Present scenario in the public places where proper disposal is not being done because of which we come across overflow dustbins. Even the private areas which are clean enough failed to utilize the resources efficiently. To properly manage the waste it has to be handled, segregated, transported and disposed so as to reduce the risks to the public lives and sustainable environmental There is a rapid increase in capacity and categories of solid waste as a result of urbanization, constant economic growth, and industrialization. Global Waste Management Market reported that the amount of waste generated worldwide produced is 2.02 billion tones. This method is easy and simple solution of segregation of three types of wastes dry, metal and wet. It is designed to sort the trash into metallic waste, wet waste and dry waste ready to be processed separately for the next process of operation for this Using Embedded technology to continuous monitoring the dustbin in order to check whether dustbin is full or not. Wireless sensors sense the amount of waste in the containers if it reached the maximum container capacity, sends instant messages to the trash management department which deploy them to collect the garbage in no time. By implementing this product at different location, instead of driving blindly on the static routes, we can optimize the collection schedule.

3. System design

A. *IR sensor*

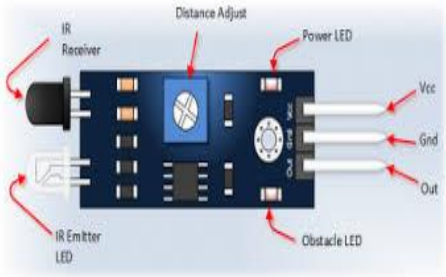

Fig.1. IR sensor

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received. IR Sensor IR Sensor Circuit Diagram and Working Principle an infrared sensor circuit is one of the basic and popular sensor module in an electronic device.

IR Sensor Module Features

- 5VDC Operating voltage
- I/O pins are 5V and 3.3V compliant
- Range: Up to 20cm
- Adjustable Sensing range
- Built-in Ambient Light Sensor
- 20mA supply current
- Mounting hole

B. *Metal proximity sensor:*

This is the circuit diagram of a low cost metal detector using a single transistor circuit and an old pocket radio. This is nothing but a Colpitts oscillator working in the medium band frequency and a radio tuned to the same frequency. First, the radio and the circuit are placed close. Then the radio is tuned so that there is no sound from the radio. In this condition, the radio and the circuit will be in the same frequency and the same frequencies beat off to produce no sound. This is the set up. When the metal detector circuit is placed near to a metal object the inductance of its coil changes, and so do the frequency of oscillations. Now the two frequency will be different, there will be no cancelling and the radio produces a hissing sound. This means a metal object is detected.

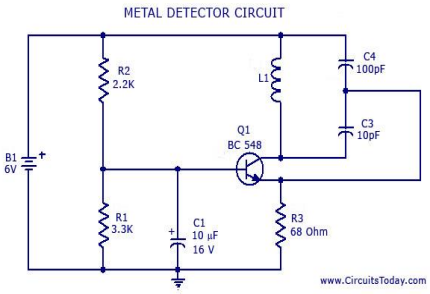

Fig. 2. Metal detector

This simple circuit consists of the following parts:

- Resistor – 3.3 k ohm – 1 nos
- Resistor – 2.2k ohm – 1 nos
- Resistir – 68ohm – 1 nos
- Capacitor – 10uF/16V – 1 nos
- Capacitor – 10pF – 1 nos
- Capacitor – 100pF – 1 nos
- Battery – 6V
- NPN transistor – BC548 – 1 nos

C. Capacitive proximity sensor

Capacitive proximity sensors are used for non-contact detection of metallic objects & nonmetallic objects (liquid, plastic, wooden materials and so on). Capacitive proximity sensors use the variation of capacitance between the sensor and the object being detected. When the object is at a preset distance from the sensitive side of the sensor, an electronic circuit inside the sensor begins to oscillate. The rise or the fall of such oscillation is identified by a threshold circuit that drives an amplifier for the operation of an external load. A screw placed on the backside of the sensor allows regulation of the operating distance. This sensitivity regulation is useful in applications, such as detection of full containers and non-detection of empty containers. The operating distance of the sensor depends on the actuator shape and size and is strictly linked to the nature of the material.

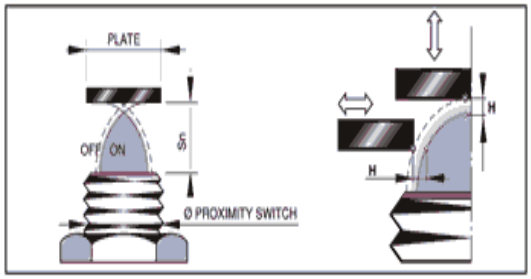

Fig. 3. Capacitive sensor

D. Servomotor

There are lots of servo motors available in the market and each one has its own speciality and applications. The following two paragraphs will help you identify the right type of servo motor for your project/system. Most of the hobby Servo motors operates from 4.8V to 6.5V, the higher the voltage higher the torque we can achieve, but most commonly they are operated at +5V. Almost all hobby servo motors can rotate only from 0° to 180° due to their gear arrangement so make sure you project can live with the half circle if no, you can prefer for a 0° to 360° motor or modify the motor to make a full circle. The gears in the motors are easily subjected to wear and tear, so if your application requires stronger and long running motors you can go with metal gears or just stick with normal plastic gear. Next comes the most important parameter, which is the torque at which the motor operates. Again there are many choices here but the commonly available one is the 2.5kg/cm torque which comes with the Towerpro SG90 Motor. This 2.5kg/cm torque means that the motor can pull a weight of 2.5kg when it is suspended at a distance of 1cm. So if you suspend the load at 0.5cm then the motor can pull a load of 5kg similarly if you suspend the load at 2cm then can pull only 1.25. Based on the load which you use in the project you can select the motor with proper torque. The below picture will illustrate the same.

Tower Pro SG-90 Features

- Operating Voltage is +5V typically
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°
- Gear Type: Plastic
- Rotation: 0°-180°
- Weight of motor: 9gm
- Package includes gear horns and screws

D. Arduino Nano Microcontroller

Arduino Nano is a small, compatible, flexible and breadboard friendly Microcontroller board, developed by Arduino.cc in Italy, based on ATmega328p. It comes with exactly the same functionality as in Arduino UNO but quite small in size. It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V. Arduino Nano pinout contains 14 digital pins, 8 analog pins, 2 reset pins and 6 power pins.

Features of Arduino Nano

- It supports different ways of communication, which are:
- SPI Protocol
- I2C Protocol
- It has crystal oscillator of 16MHz
- It's operating voltage vary from 5V to 12V

Fig. 4. Arduino Nano microcontroller

E. Processing Software

Processing is an open source graphical library and integrated development environment (IDE)/playground built for the electronic arts, new media art, and visual design communities with the purpose of teaching non-programmers the fundamentals of computer programming in a visual context. Processing uses the Java language, with additional simplifications such as additional classes and aliased mathematical functions and operations.

4. Process development

The Block Diagram shown in fig. 5. represents the automated waste material segregator where three types of materials are segregated namely Metal, Glass and Plastic. The controller used is Arduino UNO. An object is placed on the conveyor which runs on a motor of 12v, 2A which is connected through the motor driver and which is programmed to run in clockwise and anti-clockwise direction by the Arduino. The object is placed on the conveyor, depending on the output from IR sensor and Inductive sensor the motor driver the motor either in clockwise

if the material is metal or anti-clockwise direction if the material is non-metal. Metal is collected in a bin wherein IR sensors are used for level detection. The non-metal object moves in anti-clockwise direction towards the Capacitive Sensor, if the capacitive sensor output is high meaning to say the material is glass then the motor driver stops the conveyor motor and the Arduino controller drives the Motor so asto push the glass material to the bin which is also equipped with IR sensors. If capacitive Sensor output is low then the conveyor motor rotates in the same anti-clockwise direction and the plastic material is collected in the bin with IR sensors for level detection. The figure in Fig. 6 illustrates the experimental set up including all the components used and Fig. 7 shows 3D model of experimental set up of automated material segregator. The various components used are explained in the coming part. Flow diagram of Automated material segregation The Fig. 5 illustrates the flow diagram of automated material segregator including all the components used.

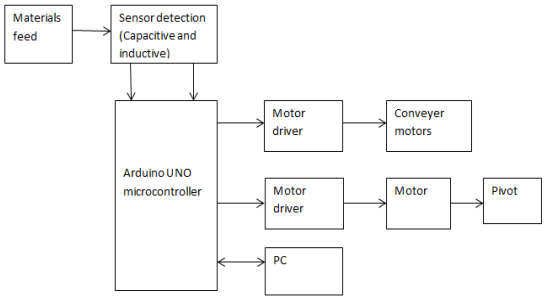

Fig. 5. Block diagram

5. Experimental setup

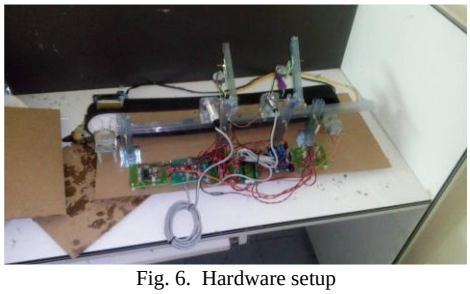

Fig. 6. Hardware setup

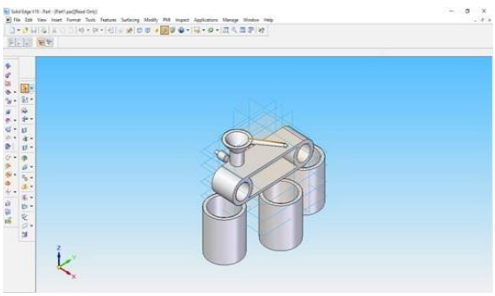

Fig. 7. 3-D model

6. Conclusion

The proposed method is an efficient solution to the current waste management problem which effectively segregates metal, glass and plastic which can also be used to segregate wet waste, dry waste etc. This system can be effectively deployed in industrial material segregation, scrap shops etc. The Automated Material Segregation system (AMS) effectively employs inductive proximity sensor to identify metallic items, and capacitive proximity sensors to. Our proposed work aims at segregation of waste materials in particular metal, glass and plastic. It is the first step towards recycling. Recycling the waste materials has a huge impact on the economic condition of the country since recycling of plastic can reduce the manufacture of plastic using renewable resources and it also has an immense effect on the environment by effectively managing the solid waste. However, many up gradations can be done to our existing project. Some of which are listed below. Advanced processing techniques can be incorporated once the waste has been segregated. The Capacitive sensors available read only the digital values hence capacitive sensors which can read analog values needs to be designed which can then be used to segregate any kind of material depending on the di-electric constant of each material. This could well reduce the overall cost of the system Methods for individual material feeding for local use so that the segregation can be per-formed continuously once the waste is dumped. Image sensing can be used to segregate materials through Image processing technology.

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