Automatic Waste Segregation Machine

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ABSTRACT

With the increase in development of smart cities, the idea of keeping the cities clean is the utmost requirement. The amount of garbage produced is too large and the manual efforts required to process it is very tedious. With evolution of technology in every field, automated ways can be adopted to prevent the piling of the garbage. The waste segregator is designed to provide ease in the disposal of waste that is collected. The system consists of three bins, each one for wet, metal, and dry waste. The conveyer belt system detects the incoming waste and classifies it as metal, dry or wet using different sensors connected to the system and deflects it in the respective bin. The deflection procedure is carried out by the servo motors which are programmed according to the working. This facilitates in processing the different kinds of waste as per the requirement. The whole setup brings about automation and hence reduces the human intervention required in segregating the waste and provides successful collection of the garbage from the bin at the appropriate time. The system is driven by a microcontroller- Arduino UNO, and the sensors are programmed using the language- Embedded C.

Keywords- Dry, wet, metal, sensors, Arduino UNO, Embedded C

1.INTRODUCTION

With the increase in population year after year, the amount of waste generated is increasing tremendously. This has led to many hazardous problems. The accumulation of the waste in large areas of land results in the formation of landfills which have dangerous consequences. The odour of the rotten waste pollutes the surrounding environment by releasing a foul smell. The disposal of the waste in water bodies contaminates all the linking oceans and seas which affect the quality of drinking water and also the lives of the water animals. The toxic gases are released into the air and in turn the whole ecosystem is affected. Therefore waste management is a very serious issue in today's era. If the waste produced is effectively handled at the source level, a lot of things can be changed and prevented.

The segregation of waste into wet, dry and metallic categories can help in discarding the waste appropriately and in implementing the principle of Reuse, Reduce and Recycle. The wet waste can be decomposed to produce manure for the plants, the metallic waste and the dry waste can be recycled. Thus the Automatic Waste Segregator has a lot of applications in the management of the waste. The system separates the waste in 3 different bins under the category of wet, dry and metallic. Different sensors are used for the detection of the type of waste. The level of the garbage in the bins is monitored continuously so that the bins don't overflow and they are emptied timely. The notification is sent to the concerned authority with the location at which the bin is placed.

2 ..EXISTING SYSTEM

The effective separation of garbage into three categories— wet, metallic, and dry—is the particular focus of this study. The system uses three important sensors—a moisture sensor, a metallic sensor, and an infrared (IR) sensor—to do this.

Every sensor is essential for identifying the waste that it is meant to detect. The technology opens the appropriate container immediately when garbage is detected, making proper disposal easier. The incorporation of the Blink software, which enables easy control of trash separation and disposal using an Android phone, is one noteworthy aspect of this project. This function offers flexibility and convenience of use by allowing customers to manage garbage from any location. Multiple advantages can be attained by putting this automated system into place[4].

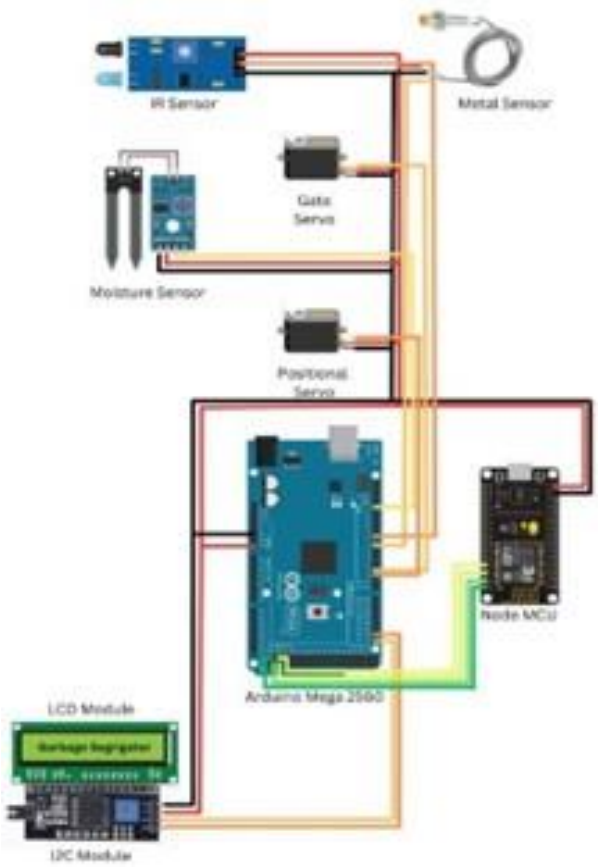
.PROPOSED SYSTEM

With this suggested system, you may monitor several waste parameters and determine the type of garbage by utilising sensors such as moisture, infrared, and metal sensors. You can find any metallic waste in the trash by using the metallic sensor. A buzzer will sound to alert the public and authorities if the amount of metallic waste reaches its maximum. In addition to serving as a reminder when the bins are full, the IR sensor can assist in the detection of dry trash and plastic waste. The moisture sensor can also identify and direct various types of wet garbage to the proper bin[7]. The fact that this project uses the Java programming language and Firebase database to develop the Blink app, which enables for remote waste level monitoring, is impressive.

CIRCUIT DIAGRAM

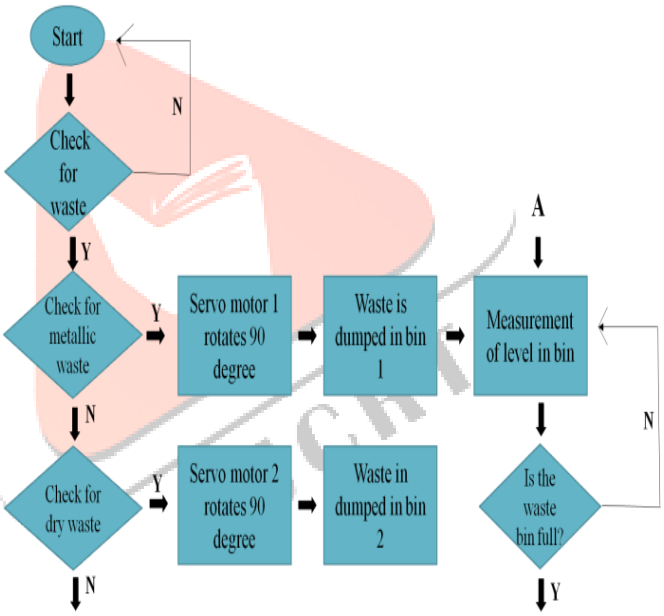
The segregator bin was tested for various materials . Following some delay, the materials fell into the appropriate compartments. Compartment A is for dry waste, compartment B is for wet waste and compartment C is for metallic waste. The LCD also displays the type of waste that is placed on the tray.

Additionally, LCD displays a message that indicates which compartment is full, depending on the readings of two IR proximity sensors fitted in each compartment of the segregator bin.



METHODOLOGY

The Automatic Waste Segregator System is driven by the Microcontroller Arduino UNO. All the components that are connected to Arduino UNO are programmed using the Arduino IDE. The program is written in Embedded C language and it reads the input/output pins of the components. The conveyor belt system moves when it senses the garbage. The servo motors are present to deflect the wet, dry and metallic waste into the specific bins. The metallic waste is detected by Inductive Proximity sensors. The dry waste has paper and plastic which are differentiated using the Capacitive Proximity sensor. The wet waste is examined with the help of Moisture sensor. The measure of the dustbin level is calculated by the Ultrasonic sensor connected at the edge of the dustbin. When the dustbin is full, a message- "BIN IS FULL" is sent to the cleaning authorities. The message is sent using the GSM module that provides the communication between the bin and the authority. The location of the bin can also be sent. The location is known with the usage of GPS module that is connected to the system. The fig.1 shows the stepwise working of the whole system.



I. HARDWARE REQUIREMENTS

ARDUINO UNO- It is an "open-source electronics platform" dependent on simple to interface hardware and execute programming. The assortment of chip and controllers is done with the help of Arduino board structures. The Arduino boards are equipped with 14 digital pins for input or output, and 6 analog pins for input that are used to interface different circuits. The customization of microcontrollers is done by utilizing Embedded C and C++ programming codes. Arduino microcontroller gives an Integrated Development Environment (IDE) that supports different programming languages. Current Arduino boards are programmed by means of Universal Serial Bus (USB).

CONVEYOR BELT- The belt is the moving object of the system. The system is a combination of at least two pulleys that ensure circular movement of the belt which pivots about them. The belt and the object placed on it move forward as the pulleys are powered. The pulley which is powered is the driver pulley and the unpowered pulley is the idler pulley.

DC MOTOR- It is utilized to drive the conveyor belt. It is interfaced with the Arduino UNO by means of L298 bridge IC. The direct current energy is converted into mechanical energy with the help of the rotational motor. A variable supply voltage is used to control the speed of the engine. The speed is also affected by changing the quality of current in the field windings.

SERVO MOTOR- It is used to deflect the waste to the respective bins. A servomotor is defined by "a rotary actuator or linear actuator that takes into account exact control of angular or linear position, velocity and acceleration." A suitable motor is coupled to a sensor for obtaining position feedback. The digital or analog input control signal represents the position directed for the output shaft.

MOISTURE SENSOR- It is used to identify if the garbage is wet or dry. The content of moisture in the waste is tested and accordingly it is dropped in the appropriate dustbin.

PROXIMITY SENSOR- The presence of objects is detected without any physical contact with the help of proximity sensor. It detects objects by "emitting electromagnetic field or electromagnetic radiation and observes the changes in the field or return signal." The Inductive proximity sensor is used to identify the metallic waste. For the identification of paper and plastic Capacitive Proximity sensor is used. It also differentiates between them as paper and plastic have different permittivity value.

ULTRASONIC SENSOR-

It is used to keep check on the garbage level of the bin. The acoustic Ultrasonic sensor is divided into three categories: receivers, transceivers and transmitters. The transmitters radiate the ultrasound by converting electrical signals into ultrasound. It is then reflected by the obstacle and received by the receiver that converts the ultrasound into electrical signal. The reflected signals are used to interpret the position of the garbage in the bin.

GPS MODULE-

It is a routing device that is connected with the Arduino UNO that uses the Global Positioning System (GPS) to determine the location of the bin. The recorded location is sent to the authorities using the GSM module embedded in the unit.

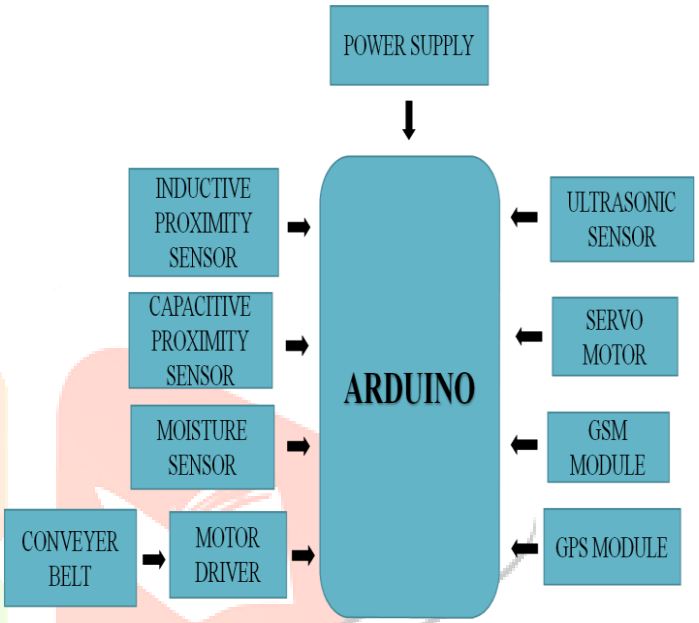


Fig. 2. Block diagram of the proposed system

II. SOFTWARE REQUIREMENTS

ARDUINO IDE-

A cross platform application comprising functions that are coded in Embedded C and C++. The programs are written and uploaded to Arduino boards using the IDE. In this system, the program is written in Embedded C for the working of the hardware components. The program consisted of separate methods for the detection of metallic, dry and wet waste. One method was written for sending the message to the authorities along with the location of the bin. The location of the bin was determined by another method that programmed the GPS module. The program code written on Arduino IDE was then fed to the Arduino for the working of the whole system.

CONCLUSION

With the second largest population in the world, India is a developing country which has large amount of waste produced everyday. There is production of 62 million tons of municipal solid waste (MSW) each year in Urban India. 70% of which is collected and 20% gets treated. Because of

the nature of different types of waste it is very difficult to discard the waste. Segregation plays a very important role by reducing the waste by reusing. Treating the waste also becomes easier if segregation is done at the base level. The fig. 3 shows the increase in the waste generated from the year 2016, to 2030 till 2050 across various parts of the world.

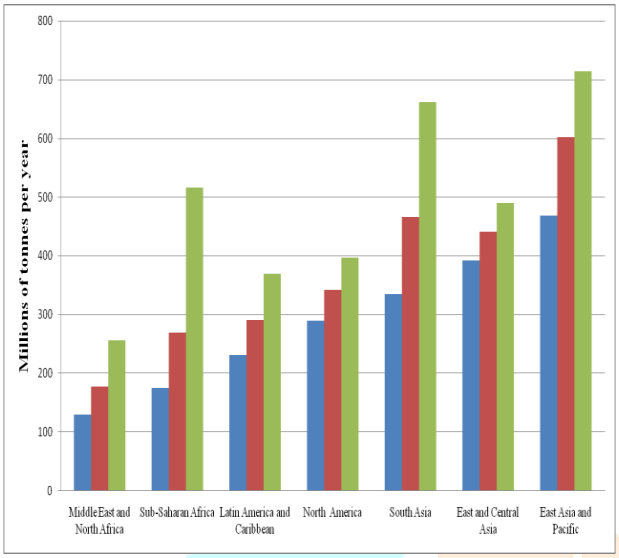


Fig. 3. Estimated increase in waste production across the world till the year 2050. The blue data represents the year 2016, red represents 2030, and green represents 2050.

Hence this indicates the increase in requirement for efficient processing of the waste to maintain ecological balance. The model developed in this paper is efficient and durable since it requires less power for its operation and no human supervision. The model can also detect when the bin is full asking the authorities to come and collect. This efficiently reduces man power, wastage of time and fuel required by the collecting van. This model fits perfectly as a replacementt to older bins and works well with the idea of smart city. With the future scope the bins can be made solar powered with better segregation techniques like digital image processing and the waste collected in the bins can be made compact to increase the storage capacity.

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