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AUTOMATED MEDICAL WASTE SEGREGATION MACHINE USING ARDUINO CONTROLLER

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Abstract **-The prime aim of this presentation is to project a novel new way for municipal waste segregation in India where most of the waste separation at present are done by rag pickers who mainly separate all the waste including harmful hospital wastes and containers containing harmful heavy metals by hand thereby leading to adverse chronic health effects like tuberculosis, cancer and heavy metal poisoning which may lead to decreased standard of living, decreased longevity and also after effects to generation of children born to such affected parents.This paper describes an Medical Waste Segregation. We are developing a prototype for separating out metals from waste materials using Arduino Controller. In this system the waste will be fed to the conveyor belt through an automatic feed system which will comprise of a hopper and other mechanism. Sensors will detect the waste material on the conveyor belt and start the rotation of conveyor belt. After this, metal Sensors which are clamped below the conveyor belt, will sense the metal particles such as needles, razors, surgical knives etc... and in turn stop the conveyor belt. A robotic arm to which an electromagnet is attached will extract the metal from the waste and will deposit it into a bin. Rapid increase in population has led to improper waste management in metro cities and urban areas which has resulted in spreading of diseases. It is estimated that 2.02 billion tones of municipal solid waste was generated universally in 2016. The segregation, transport, handling and disposal of waste must be managed properly to minimize the risks to the public, and the environment.**

I. INTRODUCTION

Hospitals produce a vast amount of potentially dangerous wastes. Because there are so many people working in hospitals, serving all different types of functions, everyone from the doctor to the janitor needs to know the proper protocols for disposing of dangerous wastes. Otherwise, the wastes could pose problems for the hospital staff and/or public by making them vulnerable to infectious diseases such as AIDS, typhoid, boils, and Hepatitis A or B.

For example, dioxin, a product of burnt plastics, can also cause cancer, birth defects, and related problems. Therefore, plastics must be disposed of differently then other waste products.

The rising population of India poses serious threats with regard to the availability of living space, utilization of natural resources and raw materials, education and employment. But another serious peril that follows is the escalating amount of waste generated each minute by an individual. Every city is grappling with the menace of ever increasing waste. An astounding 0.1 million tons of waste is generated each day in our country. Sadly, only 5% of this colossal amount of waste is recycled. In India.

Cllection, transportation and disposal of MSW are unscientific and chaotic. Uncontrolled dumping of waste on outskirts of towns and cities has created overflowing landfills which are not only impossible to reclaim because of the haphazard manner of dumping but also has serious environmental implications. One possible solution for this problem could be segregating the waste at the disposal level itself. When the waste is segregated into basics streams such as wet, dry, metallic, plastic, the waste has higher potential of recovery, and consequently, recycled and reused. The wet waste fraction is often converted either into compost or methane-gas or both. Compost can replace demand for chemical fertilizers, and biogas can be used as a source of energy. The metallic waste could be reused or recycled. Even though there are large scale industrial 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 material is retained for recycling which means that more value could be recovered fromthe waste . The occupational hazard for waste workers is reduced. Also, the segregated waste could be directly sent it to the segregation plant then to the recycling plant. Currently there is no system of segregation of dry, wet, plastic and

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metallic waste at household level has recommended that a last ost most appropriate technological option for safe management should be developed the purpose of this project is the realization of compact, low cost and user friendly segregation system for urban household to streamline the waste management process.Fig 1.1 shows the characterization of bio - medical waste.

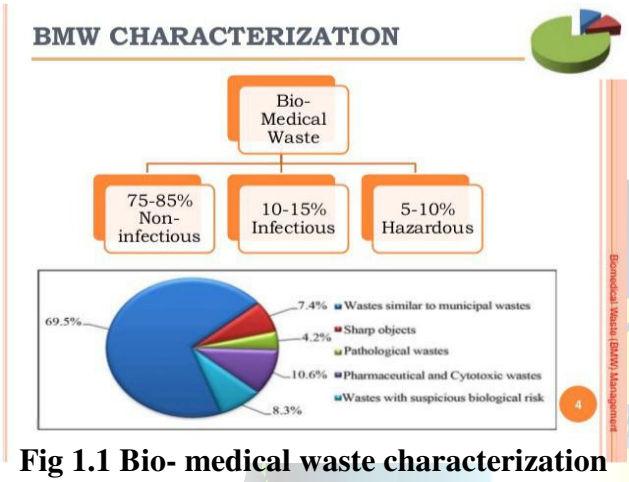

Fig 1.1 Bio- medical waste characterization

II.PROPOSED TECHNOLOGY

Implementing waste management strategies in hospitals is grounded in a process chain that includes many steps, including generation, segregation (removing hazardous wastes for treatment), collection, storage, processing transport, treatment, and disposal. Many hospitals also focus on educating management and staff, emphasizing concepts such as reuse, recycling, and segregation. most of the existing methodologies doent provide a way to seperate waste based on its nature of the matrial (metal or plastic or other forms) it only segregates depending on the particle size.

This proposed methodology segregates waste in an automated way and also helps to monitor and count the amount of waste processed. Through the use of this technique recycle of waste could be possibly increased.

The main objectives of this project are,

- To estimate the amount ,type and source of waste helps hospitals manage its collection,handling and disposal.
- To design specifications for the collection methods such as bags, containers and containers.
- The ultimate objective is to protect the public health and environment. Hospitals reduce environmental risks through waste management procedures and policies.

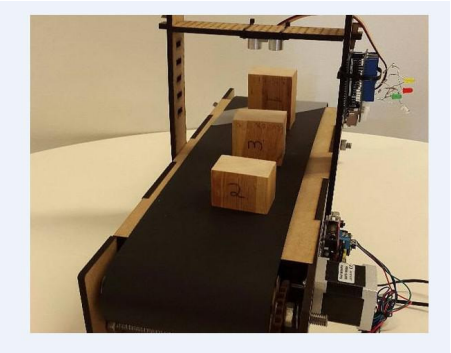

Fig 1.2: Automated Medical Waste Segregator

III.STUDY OF SENSORS AND COMPONENTS

PIR SENSOR

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses.

They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. PIRs are basically made of a pyroelectric sensor(which you can see below as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves.

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The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

Along with the pyroelectic sensor is a bunch of supporting circuitry, resistors and capacitors. It seems that most small hobbyist sensors usethe BISS0001 ("Micro Power PIR Motion Detector IC"), undoubtedly a very inexpensive chip. This chip takes the output of the sensor and does some minor processing on it to emit a digital output pulse from the analog sensor.

METAL DETECTOR SENSOR

An Metal detector is nothing but a inductive proximity sensor The inductive sensor is based on Faraday's law of induction. Inductive proximity sensors operate under the electrical principle of inductance. Inductance is the phenomenon where a fluctuating current, which by definition has a magnetic component, induces an electromotive force (emf) in a target object. To amplify a device's inductance effect, a sensor manufacturer twists wire into a tight coil and runs a current through it.An inductive proximity sensor has four components; The coil, oscillator, detection circuit and output circuit. The oscillator generates a fluctuating magnetic field the shape of a doughnut around the winding of the coil that locates in the device's sensing face.When a metal object moves into the inductive proximity sensor's field of detection, Eddy circuits build up in the metallic object, magnetically push back, and finally reduce the Inductive sensor's own oscillation field. The sensor's detection circuit monitors the oscillator's strength and triggers an output from the output circuitry when the oscillator becomes reduced to a sufficient level. Fig 2.1 shows the circuitry of an inductive proximity sensor

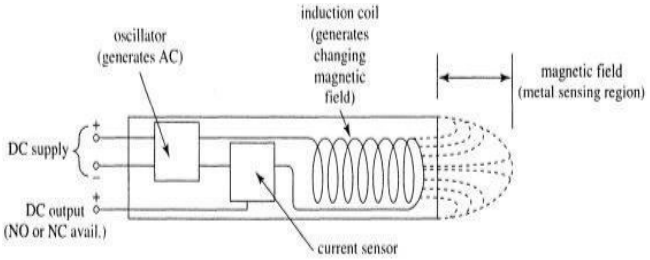

Fig 2.1 Inductive Proximity SensorC MOTOR

A DC motoris any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motorcan operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

Fig 2.2 : DC Motor

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CONVEYOR

A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium—the conveyor belt—that rotates about them.

PUSHING MECHANISM

A pushing mechanism is provided to split up the waste acording to its category either metalic or recycleable or non recycleable. In case of segregation of metalic waste the arm is fitted with a electro magnet that could attract the metalic matericals and dispose off them into the trash bin. The pushing mechanicsm is capable to move front and back as per the response from the controller.

ARDUINO CONTROLLER

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on wiring), and the arduino software (IDE), based on processing.Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50 . The arduino we use here id ARDUINO UNOR3.

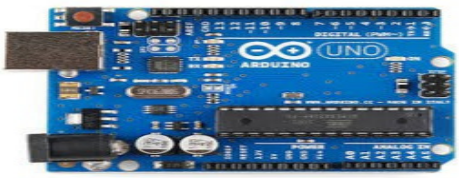

Fig 2.3 ARDUINO UNO R3

ADDITIONAL COMPONENTS

We also uses a hopper for the supply of medical waste into the conveyor .A LCD display is provided in order to display the inlet count, recycleable and non recycleable count of the waste materials.

GENERAL DESCRIPTION

The waste is fed to the conveyor through a automatic feed system that consist of a hopper. Once the supply is given the conveyor gets keep on rotating. The DC motor is used for rotating the conveyor. IR sensor keeps on detecting the object in the conveyor. When the IR sensor doesn't detect the object for particular seconds the DC motor will stop the conveyor. When IR sensor is detected, the product will keep moving in the conveyor, then if it is detected by the metal detector the robotic arm will push the material into the trash bin and consider it as a metal product. If it is not detected by the metal detector the product will keep moving in the conveyor. Then next sensor will detect the product and push the product into the trash bin based on the size of the waste material.The overall conveyor setup is controlled by the arduino controller using Embedded C programming.

IV.BLOCK DIAGRAM AND DESCRIPTION

The main objective of this project is to segragate the medical waste that are disposed off from the hospitals. The waste are initialy fed into the hopper and the inlet waste then reach the conveyor. A passive IR sensor is fitted at the inlet of the conveyor. When the conveyor is identified with a waste then the motor gets on and conveyor starts to rotate . If any metal waste such as surgical knifes, needles or any such metalic materials is present it would be identified with the help of metal inductive proximity sensor and again the motor gets switched off now a robotic arm fitted with electro magnet takes away the metal wastes then the metal detector ensures there is no more metalic waste and then the conveyor starts its movement. Another IR sensor is provided so as for the sepeartion of recylable and non recylable waste.

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The IR sensor identifies the materials as per its size. Bottles and other large sized plastic wastes are identified and then disposed off with the help of a pushing mechanism and then the remaining waste that are non recylable such as cotton, gloves and other materials. The IR sensoor at the end of the conveyor is to ensure that there are no more waste and to switch off the motor.

A LCD display is provided to display the total calculation of wastes.The overall conveyor setup is controlled by the arduino controller using Embedded C programming.

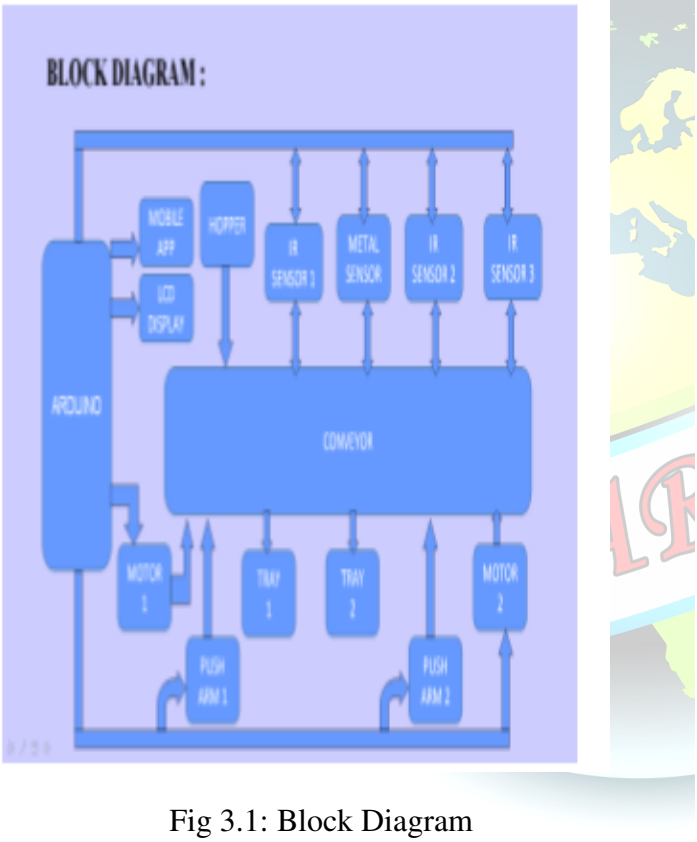

Fig 3.1: Block Diagram

FLOW CHART :

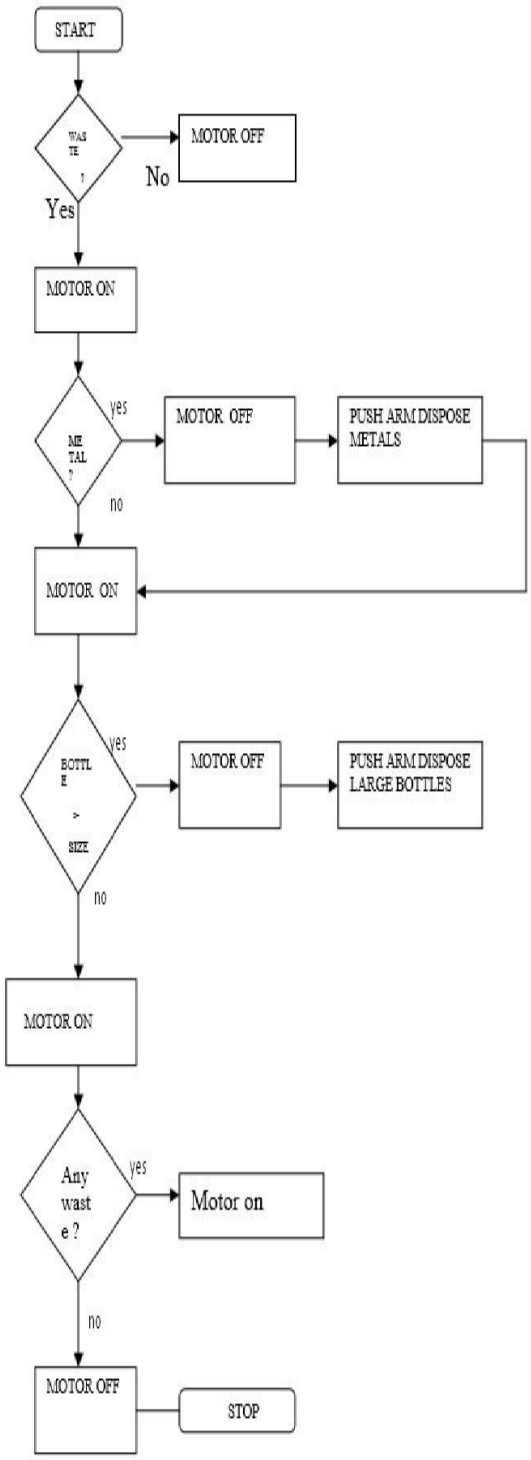

Fig 3.2 : software impolementation flow chart

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V.RELATED WORKS

M.K. Pushpa [1] describes paper about microcontroller based automatic waste segregator. The proposed system uses an inductive proximity sensor to detect metal waste and blower mechanism to segregate between wet and dry wastes. A simple 8051 microcontroller forms the heart of the system. It controls the working and timing of the entire sub sections.

Subhasini Dwivedi [2] proposes a solid waste treatment plant for separating plastic, glass bottles and metal cans from solid waste material. The system uses different capacitive, proximity sensors to detect each object which is moving on a conveyer belt and segregate into different bins with the help of hydraulic cylinder flaps. The entire system is controlled by a programmable logic controller.

S.M.Dudhal [3] describes paper deals with waste segregation using programmable logic controller. The system is developed for separating out metal from waste materials. The system consists of an automatic feed system trough which waste fed into a conveyor belt, sensors and a robotic arm to which an electromagnet is attached will extract the metal from the waste and will deposit it into a bin.

Ruveena Singh [4] describes about a smart waste sorting which automatically segregate waste into two categories namely degradable and biodegradable wastes. The proposed system consists of lid, on which the waste material is placed. There is a sensor which transmits the signals and that signal received by the microcontroller, depending on the signal is received the lid of system works and put the waste into corresponding bin.

VI. FUTURE SCOPE

This project has been made using Arduino controller and sensors such as metal and passive IR. Also the project can be done by using PIC controller, MSP 430 or any other high end microcontroller. The project can further be implemented in industries on a bigger scale in order to make the correct choices for disposal of hazardous wastes and other types of harmless waste. With a designate primacy for metal, recyleable and non-recylable forms of medical waste, the system can isolate only one sort of waste at a time. Henceforth, advances can be made to separate the assorted type of waste by utilisation of buffer spaces.

VII.CONCLUSION

Automatic Medical Waste Segregator has been successfully implemented for the segregation of medical waste into metallic, recyclable and non recyclable waste at a domestic level. Hospital Management must understand the gravity of the issue and they must be able to differentiate between hospital waste and general waste. They must ensure proper identification, segregation at the source of generation, collection in prescribed colored containers, safe transportation, appropriate treatment and environmentally sound disposal of Bio-Medical Waste. They should also provide health education and training of everyone involved in the management and handling of Bio-Medical Waste. This machine provides a way to segreate the hazardous waste that could be responsible for the spreading of many dangerous and deadly diseases

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