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Automatic NODE MCU Based Waste Segregation

Anitha Rajesh Kumar[1], Deepa Ragunathan[2], Kavya Dhandapani[3], N. Meenakshi[4]
Student[1, 2, 3], Senior Assistant Professor[4]
Department of Electronics and Communication Engineering
Meenakshi Sundararajan Engineering College, Chennai, Tamil Nadu, India

Abstract:
The ever growing human population is imposing a strong demand and pressure on the environment for sustenance. This growth spurt has resulted in a steady increase in the amount of waste being disposed on a daily basis. In most of the developing countries, segregation and timely collection of waste is a major challenge. Due to inefficient waste segregation, a large amount of recyclable content goes as waste. The waste, if not separated properly, gets mixed up and may eventually leak, resulting in toxicity and may contaminate the groundwater table through poisonous methane gas. In this paper, we present a Smart Bin, a bin that is able to segregate waste at source with no human intervention and can automatically alert the waste collection center. The system segregates the medical wastage as metal, dry and wet based on the sensors . The system is used in recycling garbage. The waste is moved on the conveyor belt which moves it to the smart bin. The status and capacity of this Smart Bin can be monitored by the municipal worker over their mobile phone, connected using a NODE-MCU Microcontroller.

Keywords: NODE- MCU, smart bin

I. INTRODUCTION

A notable inflation in municipal solid waste generation has been registered worldwide. This increase can be attributed to overpopulation, industrialization, urbanization and economic growth, which have caused a significant and noticeable effect on the total solid waste that is generated. Overflowing landfills are impossible to reclaim because of the unruly accumulation of wastes on the outskirts of the cities over the years. The separator will change the direction of medical garbage handling, which is but one part of the hardware module which is available in conveyor set up. The conveyor control, sensing operations, diversion control and other operations will be controlled by the NODE-MCU controller. This controller drives the conveyor belt. This is the controller module which controls the output devices with the help of input devices such as the sensors, and a developed program. Now-a-days, industrial processes are monitored in an RTU unit. Thus, when Medical waste is being disposed, it requires the presence of an individual to monitor any decision-rule conflicts manually. If any error occurs in this process, it could lead to fatalities, so we need human involvement in today's existing system.

II. DRAWBACKS OF EXISTING SYSTEM

The most prominently used system of waste segregation today is manual segregation, which leaves a wide margin for human error. These errors can be fatal if the wastes are chemical or biomedical in nature. The existing automated methods of segregation only separate wastes based on moisture, which can lead to metals being categorized erroneously. Systems that do incorporate metal detection fail to monitor the moisture levels of wastes. The greatest disadvantage of existing methods is the lack of isolation of human effort. There is no automated monitoring or alert system to track the bin capacities remotely.

III. PROPOSED METHOD

As discussed in the previous section, human effort is needed for analyzing the medical garbage and segregating it, which is very tedious. This drawback can be overcome by our proposed system: an automated device which can be used for easily dividing and analyzing the medical garbage by the use of sensors and a NODE-MCU controller.

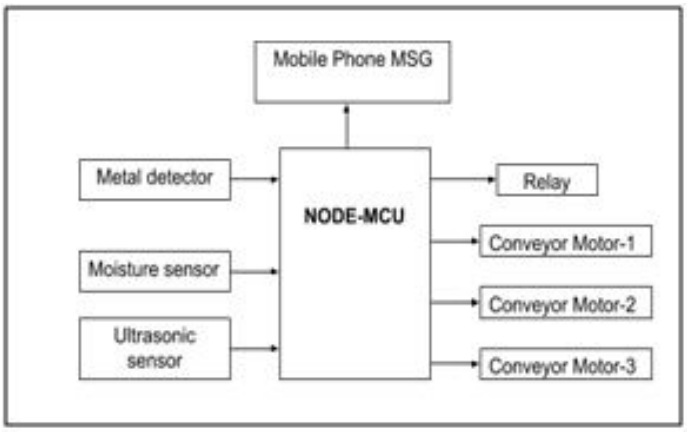

Figure .1. Block diagram of NODEMCU

Waste is kept on the conveyor belt, first sensor which is the Moisture sensor is used for wet waste detection. If the waste is not detected as wet waste it goes to the next sensor that is metal detector sensor. This sensor is used to detect any metal waste in its vicinity. After the detection the waste will be segregated. Once the waste is detected by any of the sensors the slot on which the waste is kept falls into its respective bin.

IV. COMPONENTS

A. MOISTURE SENSOR:

Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners. Soil moisture sensors typically refer to sensors that estimate volumetric water content.

Working Principle of Moisture Sensor:
The Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. The sensor creates a

voltage proportional to the dielectric permittivity, and therefore the water content of the soil.

Moisture Sensor Probe Features:

- Saves water and money.
- Pays for itself.
- Rugged design for long term use.
- Waterproof and can be buried at any depth.
- Thin blade does not disturb roots.
- Probe does not corrode over time.
- Response time.
- Accurate and precise measurement.
- Insensitive to salinity.
- Low power for battery operation.

B. METAL DETECTORS:

Metal detectors detect iron, nickel, copper, brass, aluminum, tin, lead, gold, silver and bronze. General-purpose metal detectors can find buried metal objects such as jewelry, coins and other metal objects.

"Discrimination" is a process that distinguishes between different metal targets.

The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces a magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected.

C. ULTRASONIC SENSOR:

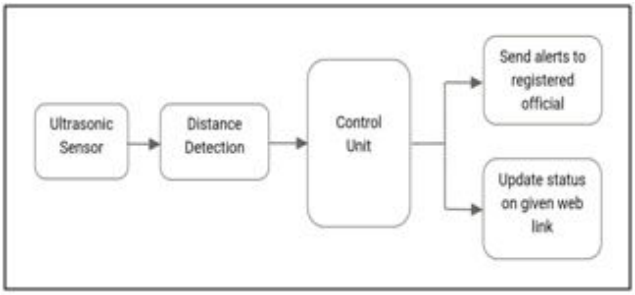

Figure .2. Example use of ultrasonic sensor in distance measurement

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. It is important to understand that some objects might not be detected by ultrasonic sensors.

D. CONVEYOR BELT:

Conveyor systems, often called conveyor belts, work by using two pulleys that continually loop over the material that rotates over them. This is done with endless procession of hooks, gears, buckets, and a wide rubber belt. The belt is then supported by a series of rollers along the path. Conveyor belts can transport products either in a straight direction or through directional changes and elevation. The purpose of the belt is to provide controlled movement of the product. Belts are designed in different sizes; systems used to run the belts operate in different speed ranges. These are the most common type of AC motor and important in industry due to their load capacity with Single-Phase induction motors being used mainly for smaller loads, like used in household appliances whereas Three-Phase induction motors are used more in industrial applications including compressors and pumps.

E. RELAY:

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits: the link is magnetic and mechanical. A relay is an electrical hardware device having an input and output gate. The output gate consists of one or more electrical contacts that switch when the input gate is electrically excited. It can implement a decoupler, a router or braker for the electrical power, a negation, and, based on the wiring, complicated logical functions containing and, or, and flip-flop. When a current flows through the coil, the resulting magnetic field powers the armature that is mechanically linked to the moving contact. The movement either makes or breaks a connection with a fixed contact. When the current to the coil is switched off, the armature is returned, by a force approximately half as strong as the magnetic force, to its relaxed position.

F. DC MOTOR:

A DC motor is 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 motor can operate on direct current but is a lightweight brushed 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.

G. NODEMCU:

NodeMCU is an open source Lua based firmware for the ESP8266 WiFi SOC from Espressif and uses an on-module flash-based SPIFFS file system. NodeMCU is implemented in C and is layered on the Espressif NON-OS SDK. The ESP8266 has 17 GPIO pins (0-16), however, you can only use 11of them, because 6 pins (GPIO 6 - 11) are used to connect the flash memory chip.The ESP8266 WiFi Module is a self contained

SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

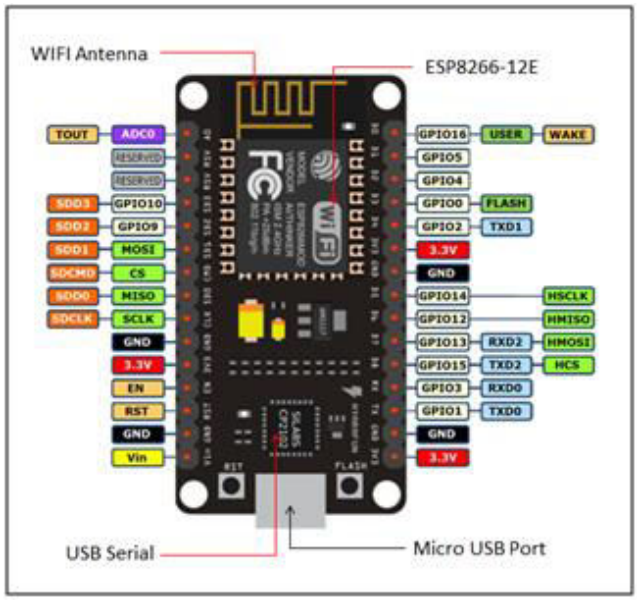

Figure .3. layout of NODEMCU

It's perfect for IoT applications, and other situations where wireless connectivity is required. This chip has a great deal in common with the Arduino – they're both microcontroller-equipped prototyping boards which can be programmed using the Arduino IDE. For those familiar with Arduino, using NodeMCU is a logical next step for a more compact, WiFi-equipped alternative.

V. CONCLUSION

The most prominently used system of waste segregation today is manual segregation, which leaves a wide margin for human error. These errors can be fatal if the wastes are chemical or biomedical in nature. The existing automated methods of segregation only separate wastes based on moisture, which can lead to metals being categorized erroneously. Systems that do incorporate metal detection fail to monitor the moisture levels of wastes. The greatest disadvantage of existing methods is the lack of isolation of human effort. There is no automated monitoring or alert system to track the bin capacities remotely.

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