SANITARY WASTE DISPOSAL SYSTEM

21TF03 MINI PROJECT -II

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BONAFIDE CERTIFICATE

Certified that this project report "**SANITARY WASTE DISPOSAL SYSTEM**" is the bonafide work of "**ANGELIN KEZIAH D(717822T105), HEMARANJEETH P(717822T126), JEEVA K K(717822T131), SHAKINA A(717822T150), SOUNDHARRAJAN T(717822T155)**" who carried out the project work under my supervision.

...…….. ……..……

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Head of the Department Supervisor

Certified that the candidate was examined during the viva voce examinations held on _____

Signature of the Internal Examiner with date Signature of External Examiner with date

DECLARATION

We hereby declare that this Project report entitled "**SANITARY WASTE DISPOSAL SYSTEM**" submitted by me for the degree of **BE in Electronics and Telecommunications Engineering at Karpagam College of Engineering, Coimbatore** is the record of original work done by me under the guidance and supervision of **Mr.S.MANIKANDAN, M.E.,(Ph.D),** Professor, at the Department of Electronics and Telecommunications Engineering, Karpagam College of Engineering, Coimbatore – 641032 and has not formed the basis for the award of any degree, or diploma or titles in this institution or any other Institution of higher learning.

Date : **Name and Signature of the Candidate(s)**

Place : Coimbatore

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ABSTRACT

Our project focuses on designing and implementing an automated sanitary waste incinerator system. Sanitary waste management is a critical aspect of maintaining public health and environmental sustainability. This project introduces an innovative approach to sanitary waste management through the development of an automated incinerator system. Utilizing an IR sensor for waste detection, an Arduino microcontroller for signal processing, and a relay-transistor mechanism for power control, the system activates a heating coil upon waste detection. A built-in time-delay ensures safe operation by automatically shutting down the incineration process after a set period. Effective waste management systems are essential for preventing the spread of diseases, protecting water sources, and preserving ecological balance. By addressing these critical concerns, our automated incinerator system offers a practical solution for sanitary waste disposal, contributing to healthier communities and a cleaner environment.

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Sanitary waste management is a critical aspect of maintaining public health and environmental hygiene in urban areas. Traditional methods of waste disposal, such as landfilling and open burning, pose significant challenges in terms of space constraints, pollution, and health hazards. Considering these concerns, there is a growing need for innovative and sustainable solutions to address the efficient disposal of sanitary waste.

Our project focuses on the development of an automated sanitary waste incinerator system, which offers a promising solution to the challenges associated with conventional waste management practices. The system is designed to detect and incinerate sanitary waste efficiently, thereby minimizing the environmental impact and promoting public health.

The key components of our system include an IR sensor for waste detection, an Arduino microcontroller for signal processing and control, a transistor for signal amplification, a relay for power switching, and a heating coil for waste incineration. The integration of these components enables the automation of the waste disposal process, reducing the need for manual

intervention and ensuring operational safety.

In this report, we present the design, implementation, and performance evaluation of our automated sanitary waste incinerator system. We discuss the methodology employed in the development of the system, including the selection of components, circuit design, and programming of the Arduino microcontroller. Furthermore, we describe the functionality of each component within the system and elucidate the sequence of operations involved in the waste disposal process.

Through this project, we aim to provide a cost-effective and efficient solution for sanitary waste management, contributing to environmental sustainability and public health improvement. By automating the waste disposal process, our system offers numerous benefits, including reduced environmental pollution, minimized health risks, and enhanced operational efficiency.

CHAPTER II

PROJECT MODULES

2.1 BLOCK DIAGRAM AND EXPLANATION:

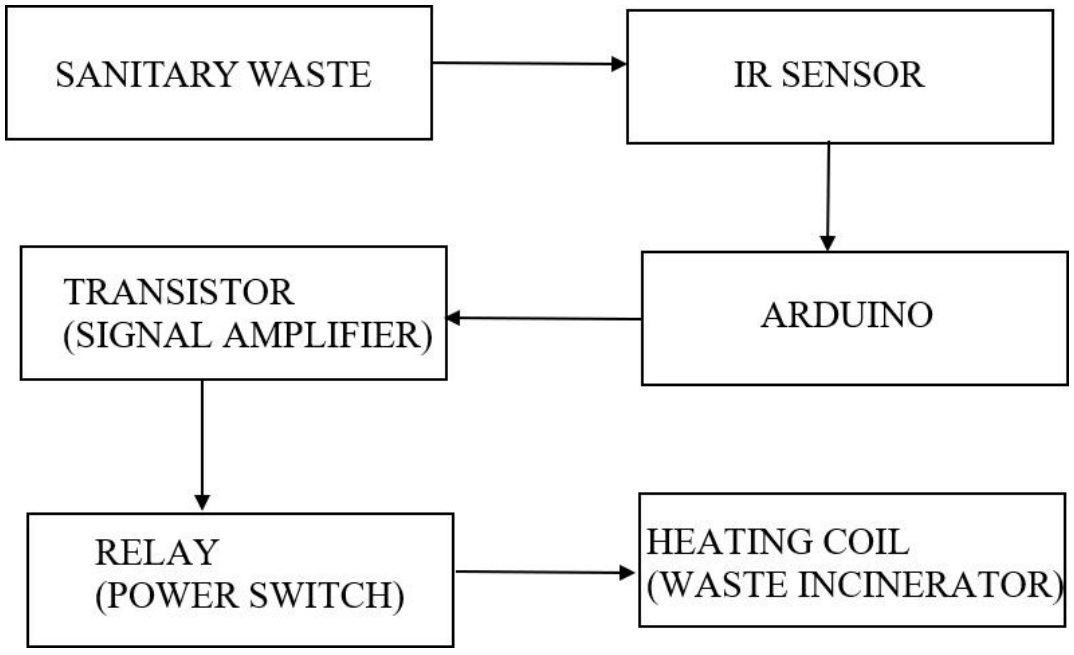

Fig 2.1 Block Diagram

The block diagram outlines the operation of an automated sanitary waste incinerator. Sanitary waste is detected by an IR sensor, signaling an Arduino microcontroller. The microcontroller triggers a power circuit through a transistor, activating a relay to power a heating coil. This coil rapidly heats, incinerating the waste. All components are powered by a main power supply. This system provides an efficient solution for sanitary waste management, promoting sustainability and environmental health.

2.2 HARDWARE DESCRIPTION:

2.2.1 IR SENSOR:

2.2.1.1 General Description:

An IR sensor is an electronic device used to detect the presence or absence of objects by emitting and receiving infrared radiation. It typically consists of an IR transmitter and receiver housed within a module. When an object enters the sensor's detection range, the emitted infrared radiation reflects off or is emitted by the object and detected by the receiver, triggering an output signal.

IR sensors are commonly used in various applications such as proximity sensing, motion detection, and object counting due to their reliability, low cost, and ease of integration with microcontrollers. They play a vital role in automation. In this project, the IR sensor is employed specifically to sense the presence of sanitary waste with

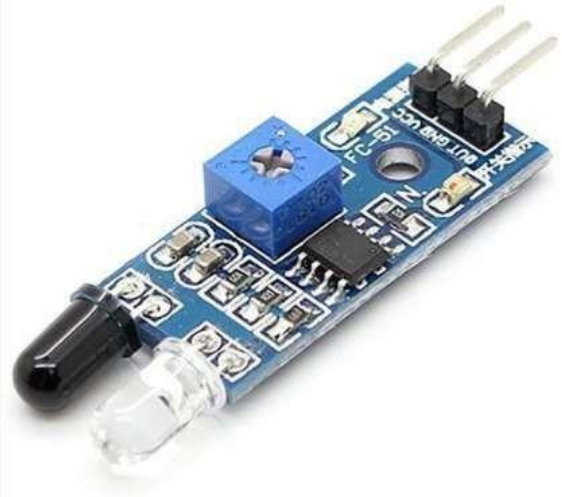

Fig 2.2 IR Sensor

2.2.2 ARDUINO:

2.2.2.1 General Description:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It consists of a microcontroller board with input and output pins that can be programmed to perform various tasks. They support a vast array of sensors, actuators, and communication modules, making them a versatile tool.

2.2.2.2 Usage in our project:

In the sanitary waste incinerator project, the Arduino serves as the central control unit, receiving input from the IR sensor to detect the presence of sanitary waste. Based on the sensor data, the Arduino executes a programmed algorithm to trigger the heating coil through a transistor and relay setup, initiating the incineration process.

Fig 2.3 Arduino

2.2.3 TRANSISTOR (BC 547):

2.2.3.1 Terminals:

The BC547 transistor is an NPN type, which means it has three terminals:

- Emitter (E)
- Base (B)
- Collector (C).

It is designed to amplify or switch electronic signals and power. The BC547 typically comes in a small plastic package with three leads (legs) for soldering onto a circuit board or connecting with wires.

Fig 2.4 Transistor (BC 547)

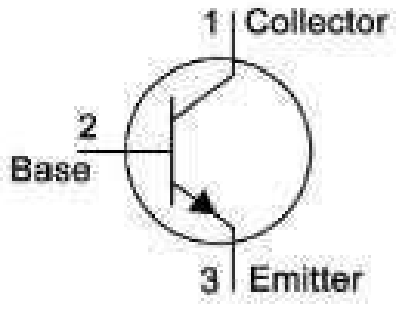

Fig 2.5 Pinout

2.2.3.2 Pin Configurations:

The pinout of the BC547 transistor is as follows: the emitter (E) is usually connected to ground or the negative side of the circuit, the base (B) receives the input signal or control voltage, and the collector (C) is where the output signal or load is connected.

2.2.4 RELAY (10 AMP):

2.2.4.1 Usage in our project:

The 10-amp relay is an electromechanical switch capable of handling up to 10 amperes of current. It operates using a coil that, when energized, generates a magnetic field to open or close its switch contacts. This relay is crucial in our project as it controls the power flow to the heating coil of the incinerator.

When triggered by the Arduino, based on signals from the IR sensor detecting sanitary waste, the relay allows power to flow to the heating coil, initiating the incineration process. It offers electrical isolation and reliability, making it ideal for high-power applications.

2.2.4.3 Applications:

Relays are commonly used in various applications, including home automation, industrial control systems, automotive electronics, and more. They provide electrical isolation between control and load circuits, allowing for safe and reliable switching of high-power devices.

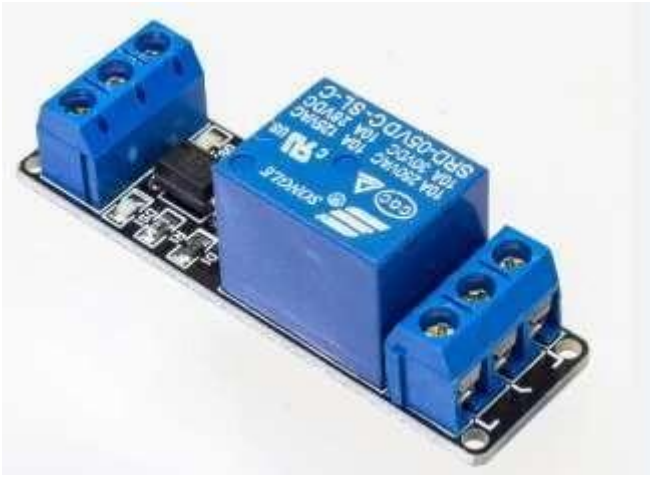

Fig 2.6 Relay (10-amp)

2.2.5 HEATING COIL:

2.2.5.1 Composition:

Typically made of a high-resistance material such as nichrome wire, the heating coil is designed to convert electrical energy into heat efficiently. Nichrome is commonly used due to its high melting point and resistance to oxidation, ensuring durability under high temperatures.

2.2.5.2 Construction:

The heating coil is usually wound into a coil or spiral shape to maximize surface area and heat distribution. It may be encased in a protective sheath or insulation to prevent damage and improve thermal efficiency. Depending on the requirements of your incinerator system, you may incorporate temperature control mechanisms such as thermostats or temperature sensors to regulate the heat output of the coil and maintain optimal operating conditions.

2.2.5.3 Safety Considerations:

Given the high temperatures generated by the heating coil, safety precautions must be taken to prevent overheating and potential fire hazards. Incorporating thermal cutoff switches or overheat protection mechanisms can help mitigate risks and ensure the safe operation of the incinerator system.

Fig 2.7 Heating Coil

CHAPTER 3

DESIGN AND WORKING

3.1 CIRCUIT DIAGRAM:

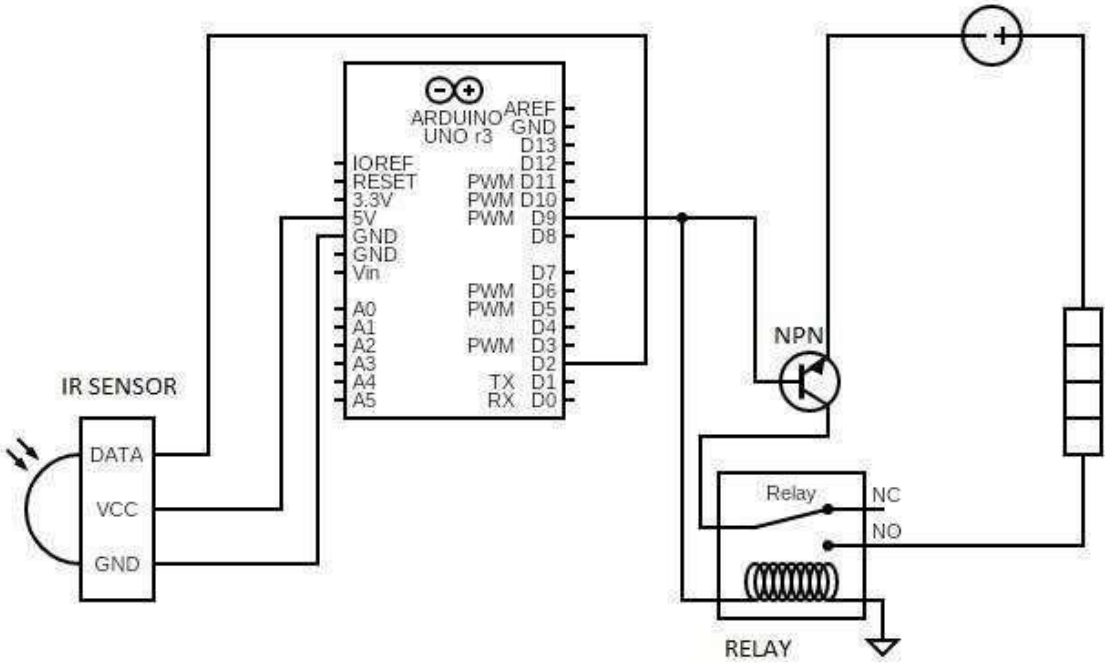

Fig 3.1 Circuit Diagram

3.2 WORKING PRINCIPLE:

3.2.1 OBJECT DETECTION:

- The system utilizes an IR sensor to detect the presence of objects, specifically sanitary waste, placed within the incinerator chamber. IR sensors are chosen for their ability to detect infrared radiation emitted by objects, making them suitable for proximity sensing applications.

3.2.2 SIGNAL PROCESSING AND DECISION MAKING:

- Upon detecting an object, the IR sensor sends a signal to the Arduino microcontroller. The Arduino processes this signal and executes programmed instructions to determine the subsequent actions.
- Using conditional statements, the Arduino decides whether to proceed with the incineration process based on the presence or absence of an object.

3.2.3 HEATING COILACTIVATION AND CONTROL:

- If an object is detected, the Arduino triggers the activation of the heating coil. The heating coil, typically made of nichrome wire, heats up rapidly when electricity passes through it.
- To control the power supplied to the heating coil, the Arduino interfaces with a relay using a transistor. The relay acts as a switch, allowing the Arduino to control the flow of electricity to the heating coil.
- By regulating the relay, the Arduino ensures precise control over the heating coil's operation, promoting efficient and safe incineration of sanitary waste.

3.2.4 AUTOMATIC SHUTDOWN MECHANISM:

- After a predetermined duration, typically 4 to 5 minutes, the Arduino initiates an automatic shutdown sequence to turn off the heating coil. This time delay ensures that the waste is adequately incinerated without consuming excessive energy or posing a risk of overheating.
- The Arduino achieves this shutdown by deactivating the relay, thereby interrupting the power supply to the heating coil. Once the coil is turned off, the system resets, ready to detect and incinerate the next batch of waste.

- This working principle provides a comprehensive overview of the mini project's operation, covering object detection, signal processing, heating coil activation and control, and automatic shutdown mechanisms.

3.3 IMPLEMENTATION OF PROJECT:

Fig 3.2 Implementation

CHAPTER 4

FLOW CHART

This flowchart illustrates the sequential steps in a sanitary waste incinerator system, from object detection to automatic heating coil operation and shutdown.

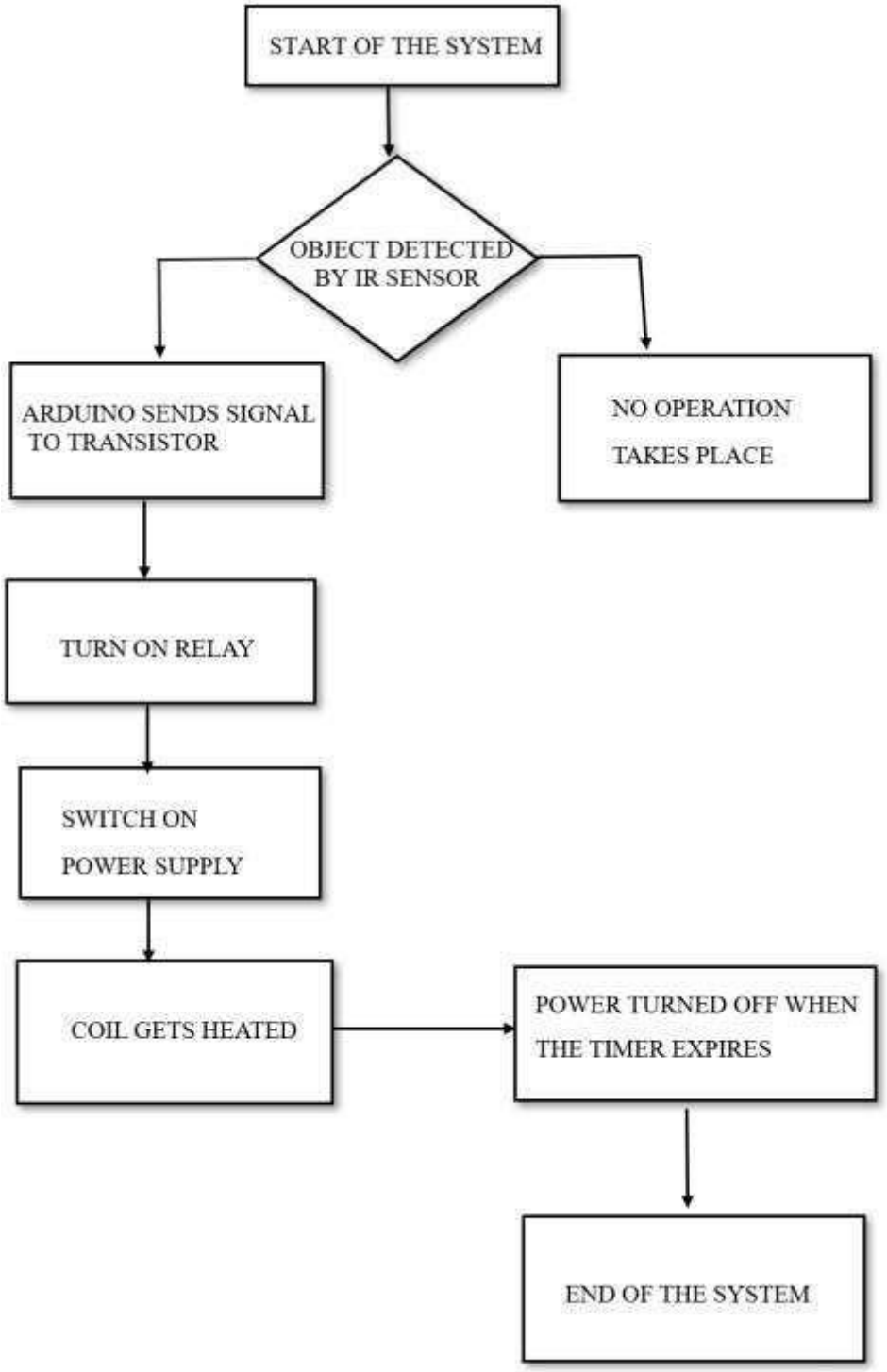

Fig 4.1 Flow Chart

CHAPTER 5

FUTURE WORKS

This project represents a basic automated incinerator system designed for sanitary waste management. Below are additional scopes and opportunities for advancing this project towards greater efficiency, sustainability, and versatility.

5.1 Integration of Sensors for Improved Efficiency:

Exploring the integration of additional sensors such as temperature sensors to monitor and regulate the incineration process more precisely. This could ensure optimal heating levels for efficient waste disposal while minimizing energy consumption.

5.2 Incorporation of Smart Monitoring and Control Systems:

Developing a smart monitoring and control system that allows remote monitoring and management of the incinerator. This could involve integrating IoT (Internet of Things) technologies to enable real-time monitoring of waste levels, temperature, and system status, as well as remote control capabilities for operation adjustments.

5.3 Implementation of Safety Features:

Enhance the system's safety features by integrating smoke and gas detectors to detect any anomalies or potential hazards during the incineration process. Automatic shutdown mechanisms could be triggered in response to such detections to prevent accidents or environmental harm.

5.4 Adoption of Sustainable Energy Sources:

Explore the possibility of integrating renewable energy sources such as solar panels or biomass generators to power the incinerator. This would reduce the reliance on conventional energy sources, making the process more environmentally sustainable and cost-effective in the long run.

5.5 Implementation of Waste-to-Energy Conversion Technologies:

Investigate the incorporation of waste-to-energy conversion technologies into the incinerator system. This could involve capturing and converting the heat energy produced during incineration into electricity or other usable forms of energy, offering additional environmental and economic benefits.

5.6 Research on Emission Control and Air Pollution Mitigation:

Conduct research on advanced emission control technologies to minimize air pollution and greenhouse gas emissions associated with incineration. This could include the implementation of scrubbers, filters, and catalytic converters to remove harmful pollutants from the incinerator exhaust gases.

By exploring these future works and scopes, the mini project on sanitary waste management through incineration can evolve into a more advanced and sustainable solution for addressing waste management challenges effectively.

CHAPTER 6

CONCLUSION

In summary, the development and implementation of the automated sanitary waste incinerator system mark a significant advancement in waste management technology. Through the integration of components like the IR sensor, Arduino microcontroller, and heating coil, the system efficiently detects and disposes of sanitary waste, promoting cleanliness and hygiene.

While the current project represents a foundational step, there is ample room for expansion and improvement. Future iterations could explore the incorporation of advanced sensors, smart monitoring systems, and renewable energy sources to enhance efficiency and sustainability.

Furthermore, scaling up the incinerator for broader use and integrating waste-to-energy conversion technologies present exciting prospects for addressing larger waste management challenges.

In conclusion, this mini project serves as a promising start towards more effective waste management solutions. By embracing innovation and continuous improvement, we can work towards cleaner environments and a more sustainable future.

APPENDIX

```
const int sensorPin = 2; // IR sensor pin

const int outputPin = 13; // Output pin

void setup() {

pinMode(sensorPin, INPUT);

pinMode(outputPin, OUTPUT);

Serial.begin(9600);

}

void loop() {

int sensorValue = digitalRead(sensorPin);

if (sensorValue == HIGH) {

// Object detected

digitalWrite(outputPin, HIGH); // Set output pin to high

delay(5000); // Wait for 5 seconds

digitalWrite(outputPin, LOW); // Set output pin to low

delay(5000); // Wait for another 5 seconds

}
```

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