SMART ECO-FRIDENLY GARBAGE MANAGEMENT GENERATING ELECTRICITY

A PROJECT REPORT

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Under the guidance of,

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SCHOOL OF COMPUTER SCIENCE ENGINEERING

CERTIFICATE

This is to certify that the Project report **"SMART ECO-FRIDENLY GARBAGE MANAGEMENT GENERATING ELECTRICITY"** being submitted by "Kavya koppuravuri, Chandana priya G, Devathi Maniteja, Sripathi Goutham" bearing roll number(s) "20201CIT0033,20201CIT0022,20201CIT0038,20201CIT0016" in partial fulfilment of requirement for the award of degree of Bachelor of Technology in Computer Science and Engineering (Internet of Things) is a bonafide work carried out under my supervision.

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DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **SMART ECO-FRIDENLY GARBAGE MANAGEMENT GENERATING ELECTRICITY** in partial fulfilment for the award of Degree of **Bachelor of Technology** in **Computer Science and Engineering (Internet of Things)**, is a record of our own investigations carried under the guidance of **DR.DIPALI K DAKHOLE,** Assistant professor senior scale**, School of Computer Science Engineering , Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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ABSTRACT

Waste segregation is a critical component of sustainable waste management. This abstract presents a unique approach to waste segregation using the Internet of Things (IoT). Our system employs smart sensors to automatically distinguish between dry and wet waste, enabling efficient recycling and composting processes. Through real time monitoring, waste collection can be optimized, reducing costs and environmental impact. This innovative IoT solution not only promotes eco friendliness but also enhances the overall efficiency of waste management systems, offering a sustainable solution to the global waste crisis. This project outlines the development and implementation of an intelligent waste management system designed to optimize resource utilization and minimize environmental impact. Integrating smart technologies for waste sorting and recycling, the system employs advanced processes such as anaerobic digestion and incineration to convert organic waste into electricity. Through real-time monitoring and data analytics, the system ensures efficient energy production while promoting sustainable waste practices for a greener future. In addition to waste sorting and energy generation, the system incorporates IoT devices and sensors for continuous monitoring of waste levels and composition. Machine learning algorithms analyze data to enhance predictive maintenance, optimize energy output, and improve overall system efficiency. This holistic approach aims to revolutionize traditional waste management by creating a self-sustaining ecosystem that not only addresses environmental concerns but also contributes to the generation of renewable energy in a smart and eco-friendly manner.

Keywords: Internet of things, Generating electricity using garbage, Segregation of dry & wet waste.

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CHAPTER-1

INTRODUCTION

1.1 INTRODUCTION TO IOT

IOT is a global infrastructure for information society Enabling advance services by inter connecting physical and virtual things based on existing and evolving interoperable information and communication Internet of Things (IoT) is a technology that connects physical objects to the internet. It is used to collect data from sensors and other devices, and then analyze it to gain insights. IoT is used in a variety of industries, such as healthcare, manufacturing, retail, and transportation. It can be used to monitor and control devices remotely, automate processes, and improve efficiency. Major vendors for IoT technology include Amazon, Microsoft, IBM, and Google. These companies provide cloud-based platforms and services that enable businesses to develop and deploy IoT solutions.

The Internet of things (IoT) describes devices with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks .The Internet of things encompasses electronics, communication and computer science engineering. Internet of things has been considered a misnomer because devices do not need to be connected to the public internet, they only need to be connected to a network ,and be individually addressable.

The field has evolved due to the convergence of multiple technologies, including ubiquitous computing, commodity sensors, and increasingly powerful embedded systems, as well as machine learning.[9] Older fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), independently and collectively enable the Internet of things.In the consumer market, IoT technology is most synonymous with "smart home" products, including devices and appliances (lighting fixtures, thermostats, home security systems, cameras, and other home appliances) that support one or more common ecosystems[clarification needed], and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers. IoT is also used in healthcare systems.

There are a number of concerns about the risks in the growth of IoT technologies and products, especially in the areas of privacy and security, and consequently there have been industry and government moves to address these concerns, including the development of international and local standards, guidelines, and regulatory frameworks.

The proposed efficient waste segregation and utilization methodology based on CNN and IoT addresses the research gaps in smart waste management systems. The proposed system is fully automatic and designed for the household level. The garbage collected from the houses is segregated as organic and inorganic waste using a deep learning network. The system processes the organic waste and produces biogas; the residual waste is utilized as fertilizers. The biogas is used to produce electric power with the help of a generator. The system monitors the inorganic waste collection bin level using sensors and sends a notification to the municipality Garbage Collecting Van operator using the IoT module. Once the bin is filled, it can be sent for recycling. The produced power from the waste can be utilized for the power requirement of garden lamps and corridor lighting in the apartments. The objective of the work is closely aligned with the United Nations SDGs Goal −11 (sustainable cities and communities)and Goal 12(Responsible production and consumption) [45]. These are also considered to be the cleaner and production aspects of the work "Smart Self-Power Generating Garbage Management System Using Deep Learning for Smart Cities" with the following modules**:**

Although technologists describe IoT as a further step towards a better society, academics and social analysts have a number of questions and concerns about the pursuit of the ever-present technological revolution. They conclude that there are major technological impacts, such as IoTs, decision-making, privacy, autonomy, and human agency. Another concern is that the use of IoT is being built quickly without sufficient recognition of the deeper security issues involved and the technological changes needed. When IoT expands, cyber-attacks or hacker attacks can become an extreme physical threat. The marketplace for publicly available sensor data may serve commercial and security interests as well as assist criminals and spies in the detection of high-value targets. IoT devices can measure the vulnerability of any cyber-attacks. Major disputes over the use of IoT devices,

including walled-out internet (for example, cross-border attacks, regulatory divergence, and economic protectionism), security-based AI issues (e.g., gird control, power system integration and system synchronization), cloud attacks (e.g., cybersecurity, big data), botnet issues (e.g., critical infrastructure, somewhat dumb devices, and public infrastructure (e.g., a huge amount of data handling capability, complex models, experts and expenses, durability, machine learning complexity, weather impacts, security encryption, situational awareness and locking of network.

Types of wastes:

Garbage :

It mainly contains vegetables and animal wastes which resulting from the handling preparation, cooking and serving of food, storage garbage comprising these wastes contains decaying organic matter which produces intolerable which attractsrats and other insects it requires a very special care in storage disposal and handling

Ashes and residues:

These are substances that which will be remains from to the composting of coal and the charcoal like coke ,wood, and the other explosive materials for heating and cooking in houses, industrial creations power generating systems of sources factories are comes under the industrial wastes, Ashes and its residues are inorganic and too in landfills.

Bulky wastes:

It consists of the large household appliances like tv, washing machine, furniture, ait conditioners , vehicles parts, wood etc. all comes under the bulky wastes that which are hard to convert into combustion they require a special collection mechanism.to burn them

Municipal services:

The municipal services that will be consisting of the urban centers also are tributary massively to the solid waste issues in most countries currently a days street cleansing wastes that will be having the form of from parks and beaches waste treatment plants landscaping wastes and wastes from recreational square measures together with sludge are a number of the solid wastes caused by the municipal services. These are the municipal services wastes.

Agriculture wastes:

Agriculture wastes will be having the crop farms, dairies , and feedlots also are coming back underneath the sources of solid wastes, agriculture will be wastes like spoiled food , chemical containers.

BIO-MEDICAL: Bio-medical wastes which are the wastes generated from hospitals, clinics, pharmacies, etc. It may also include from parts of animals or humans, needles, blood, etc.

Biomedical refers to medicine instrumentation, hospitals and chemical producing companies. differing types of solid wastes square measure made in hospitals. Syringes, bandages, used gloves, drugs, paper, plastics, food wastes and chemicals square measure a number of these solid wastes. of these on top of solid wastes square measure need correct disposal as an alternative these solid wastes can cause a giant hurt to the surroundings and other people in these facilities.

HAZARDOUS WASTES:

It is defined as waste of industrial, institutional or consumer origin that are hypothetically dangerous either immediately or over a period of time to human life and environment. This is due to their physical, chemical, and biological features like ignitability, corrosivity and toxicity.

SEWAGE WASTES:

These wastes square measure principally organic that square measure derived from the treatment of organic sludge separated from each treated and raw sewages. The inorganic fraction of raw biodegradable pollution like grit and eggshells is separated at the preliminary stage of treatment with pathogens and should be buried directly.

SOURCES OF SOLID WASTE:

Daily tonnes of solid waste is disposed off at many lowland sites. it's coming back from faculties, houses, industries, establishments, agriculture, etc. These lowland sites produces foul smell if it's not keep properly and not treated well. It leads to the polluting of the environment and that effects the human life, animal life, and similarly as surroundings.

RESIDENTIAL:

The major sources of solid waste square measure Residences and houses wherever folks live. Trash from these places embody food wastes, plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes and special wastes like large home items like physics, tires, batteries, previous mattresses and used oil. Most homelands have garbage bins in wherever they'll throw away their solid wastes and when the bin is empty by a garbage collection firm or person for treatment.

INDUSTRIAL:

Industries square measure main contributors of solid waste. It includes lightweight and significant producing industries, construction sites, fabrication plants, canning plants, power and chemical plants. solid waste is made by industries within the variety of housework wastes, food wastes, packaging wastes, ashes, construction and demolition materials, special wastes, medical wastes similarly as alternative harmful wastes.

COMMERCIAL:

Commercial facilities and buildings also are coming back underneath solid waste sources currently a days. Hotels, markets, restaurants, go downs, stores and workplace buildings square measure thought of as industrial buildings and facilities. solid wastes like plastics, food wastes, metals, paper, glass, wood, cardboard materials, special wastes and alternative venturesome wastes also are generated from
these industrial places

INSTITUTIONAL:

Schools, colleges, prisons, military barracks and alternative government centers square measure Institutional centers that manufacture solid waste. Glass, rubber waste,

plastics, food wastes, wood, paper, metals, cardboard materials, physics similarly as numerous venturesome wastes square measure common solid wastes obtained from these places.

CONSTRUCTION AND DEMOLITION:

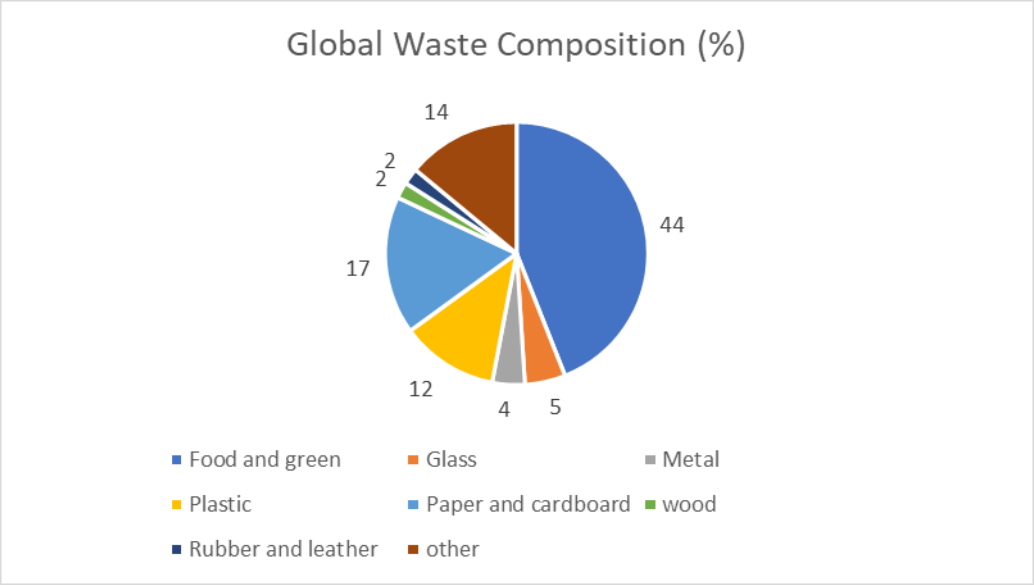
Construction sites and demolition sites also are ends up in solid waste issues. Construction sites embody new construction sites for buildings and roads, road repair sites, building renovation sites and building demolition sites. Steel materials, concrete, wood, plastics, rubber, copper wires, dirt and glass square measure a number of solid wastes made in these places.

MUNICIPAL SERVICES:

The urban centers also are tributary massively to the solid waste issues in most countries currently a days. Street cleansing wastes from parks and beaches, waste treatment plants, landscaping wastes and wastes from recreational square measureas together with sludge are a number of the solid wastes caused by the municipal services.

TREATMENT PLANTS AND SITES:

Solid waste is additionally made by significant and lightweight producing plants. They embody refineries, power plants, process plants, ore dressing plants and chemicals plants. process wastes, unwanted specification product, plastics, metal components simply to say however a number of square measure among the wastes made by these plants.



It is a frequent thought that technology is that the resolution to the matter of unmanaged and increasing waste. Technology isn't a nostrum and is typically just one issue to contemplate once managing solid waste. Countries that advance from open merchandising and different rudimentary waste management ways area unit a lot of seemingly to succeed after they choose regionally acceptable solutions. Globally, most waste is presently drop or disposed of in some sort of a lowland. Some thirty seven % of waste is disposed of in some sort of a lowland, eight % of that is disposed of in sanitary lowlands with landfill gas assortment systems. Open merchandising accounts for concerning thirty one % of waste, nineteen % is recovered through exercise and composting, and eleven % is incinerated for final disposal. Adequate waste disposal or treatment, like controlled landfills or a lot of strictly operated facilities, is sort of completely the domain of high- and upper-middleincome countries. Lower-income countries typically accept open dumping; ninety three % of waste is drop in low-income countries and solely a pair of % in highincome countries. 3 regions brazenly dump quite half their waste—the geographical area and geographical region, geographic area, and South Asia. Upper-middleincome countries have the very best share of waste in landfills, at fifty four %. This rate decreases in high-income countries to thirty-nine %, with diversion of thirty six % of waste to exercise and composting and 22% to combustion. combustion is employed primarily in high-capacity, high-

income, and land-constrained countries.

ABOUT PROJECT:

In our project the main part is to be segregating dry and wet waste from the collected garbage after that part by burning that garbage will get the bio gas from that garbage and then will be converting that bio gas into electricity and the electricity will be generated In this first part coming to dry waste Dry waste consists of waste that does not decay. It is also known as waste which cannot be biodegradable. Dry waste consists of paper, glass, Styrofoam, rubber, metal, cloth, empty bottles, stationeries, etc. and can be recycled into new products further. Before segregating, sharp materials like glass and other metals shall be kept in a separate bag/container. Coming to wet waste. Wet waste is all the kitchen waste that we produce. Example: vegetable peels, used tea bags, fruits, leftovers, coconut shells, flowers, leaves, meat or nonveg, expired food items, bread, biscuits, etc. how waste will be disposed This is organic waste which can be recycled and converted into compost. Most of the wet waste comes from the kitchen itself. Restaurants, buildings and factories need efficient wet waste management systems. Coming to the why segregation of the dry and wet waste is necessary for the segregation By segregating dry waste such as plastic, glass, metals, paper, etc. from wet waste it becomes easier to recycle them into new products. Whereas wet waste like vegetable leftovers, fruits, used tea bags etc. can be used for producing gas.

Proper WM is necessary because, it will help in reducing;

Greenhouse gas emission

Toxic gas explosions

Waste Landfill

Air, soil and water pollution, etc.

For generating electricity through this segregated waste of dry and wet garbage is to be done like compost and then from that compost electricity will be generated

Generating electricity through waste is called like energy from waste is the process of generating energy in the form of electricity and heat from the primary treatment of waste or the processing of waste into a fuel source it is a form of energy recovery most processes

generate electricity from and to the heat that will be directly through combustion then that will be produced a combustible fuel commodity and then that will be converted into a bio gas form that will be such as bio gas that bio gas will be stored when it the garbage will be composted that will be stored into the batteries that will contain switch when we are in need of the energy source the batteries will be provided the electricity to the generation of electrici

Problem statement

Nowadays, percentage of pollution is rise day by day.

Because of this we face environmental changes and climate changes.

Apart from this improper waste disposal can also have adverse health effects on humans as over the years it has been responsible for causing several diseases and in some cases even death.

Plastic is not disposal it affects the nature and produce harmful gases.

1.1.1 Segregation of dry & wet waste

Once waste is dumped into a dustbin, it is segregated using a combination of a moisture sensor, an ultrasonic sensor, and a capacitive sensor. The moisture sensor detects the moisture level, the inductive sensor detects metallic items, and the capacitive sensor tracks plastic items.

1.1.2 Generating electricity using waste

The purpose of making this project is to generate electrical energy from bad materials like dry, wet, garbage and bad stuff etc. and store that electrical energy in the battery through the circuit and use that electrical energy to operate the whole project. And the LED bulb is shown to be turned on and the use of filters controls pollution from energy production. converting heat to electricity and that electricity we can see on multimeter display, we can see how much voltage generate by waste materials and we electricity-generating perfectly

It is the unwanted or waste solid materials which are generated from humanactivitiesin houses, hotels, institutionals, labs, agriculture, industries or anycommercial areas.

In India metro cities individually produces an average of 0.8 kg/ waste/ person daily.

India has been generated municipal solid waste (MSW) estimated at 68.8 million tons per year. The average efficiency of MSW collection is 22% - 60%.

Annually the world generates 2.01 billion tonnes of MSW (Municipal Solid Waste) at least with 33% of that extremely conservatively not managed in an environmentally safe

manner. Worldwide, per person waste generated per day averages 0.74 kg but ranges widely from 0.11 – 4.54 kg. Though they only account for 16% of the world's population, developed countries generate nearly 34% (683 million tonnes) of world's waste.

By 2050 global waste is expected to grow to 3.40 billion tonnes.

INDIA 62 million tonnes of municipal solid waste (MSW) generates each year. In this about 43 million tonnes (70%) is collected and 11.9 million tonnes (20%) is treated about 31 million tonnes (50%) is dumped in landfill sites.

CHAPTER-2

LITERATURE SURVEY

2.1 Inventions

Padmakshi Venkateshwara Rao, Pathan Mahammed Abdul Azeez, 2020[1] introduces the IoT based Waste Management for Smart Cities to overcome the challenges in the environment such as inadequate waste collection, treatment, disposal. Due to flooding of the dustbin causes unhygienic conditions are created, the dustbin is placed in the entire city Recycling is the best way to create a sustainable environment and also it needs the segregation of waste materials which is a tedious time-consuming task

Dr. Elena v. Rosca, Introduces the Smart System and the Internet of Things (IoT) for waste management to provide an efficient and effective manner for waste disposal, improving the city waste management

Waste to Energy generation is basically a form process for the generation of electricity directly

or through heating first in both process we get Electricity as an output to use for the process. is process is basically completed in 3 steps and in last step we get the output All these steps involves firstly waste materials is been collected from door to door from every places which is been useful for a long time After which in second step this waste material is been purified according to their calorific values and then third step this waste is been burned out in a container where heat is been generated and in result we find to get Electricity as an output. Compared with other form of technology this is most attractive method of generation of electricity because of low cost, low pollution and easy way. This project has been carried out in some of the areas of Bihar also by a small unit call "HUSK POWER SYSTEM" which is one of the worlds leading off grid utilities which provides 24 hours a day power in rural areas.

recovered.

Chang kook Ryu and Dong hoon Shin (2012) worked on Current standing and problems on Combined Heat and Power from Municipal Solid Waste in Asian nation. This study states an outline of CHP by MSW to energy plants in Asian nation and mentioned the issuses associated with energy potency improvement. The necessary energy resource for combined heat and power production is Municipal solid waste.

Generation of power in the WtE CHP plants was projected to be solely three.65% of the thermal input and warmth production was sixty.79%. The R1 potency for the CHP plants compared to it in europe was similar and better for warmth solely plants.
In

2010, around half the fifty one massive WtE plants were CHP, whereas others made heat. up of power generation potency for brand spanking new power plants manufacturing steam at pressure on top of the present level of 20-30 bar is needed. Transboundary centralization of WtE plants between neighboring native authorities is important for warmth utilization since several existing small-scale plants don't recover heat.

D.L.Wise and R.G. Kispertmics (1981) of bioconversion of municipal solid waste (MSW) to liquid and vapourish fuels was conducted, supported data within the literature and by personal communication with developers of the processes. to produce a typical basis, processes were graded by conniving the tipping fee required to method the MSW victimization assumed costs for product fuels likewise as capital and operative expenses. No quantitative live of the comparative benefits between liquid and vapourish fuels was created. The outline results of this economic analysis were: read at intervals Article due to the assumptions that had to be created, the derived tipping fees aren't absolute however could also be thought to be "figures of merit".

Dong Liang Zhang et al (2015) has studied Key Challenges and Opportunities of Waste to Energy in China. the most important developing country within the world is china, experiencing each economic maturation and largescale urbanization. The things in china have result in waste disposal issues, and therefore the have to be compelled to establish energy sources. A supply of renewable energy, Waste to Energy conversion proceses square measure expected to play AN more and more
importance role in china's rectifiable management of municipal solid waste. The determination of this analysis is to analyze the key issues and opportunities related to WTE, to produce recommendations for the government.This paper starts by explaining china's current MSW management scenario and finding out its waste disposal issues. the key challenges allied with china's WTE incinerations square measure then mentioned from economic, environmental and social points of read. It

embrace the high prices related to construction vital facilities, the status of facilities to corrosion, the lower heating worth of china's MSW, air waste product emissions and particularly public opposition to WTE burning.

Ismael Salim Lopez (2017) Studied concerning the Energy Recovery of the Reject Materials from Municipal Solid Waste Treatment Plants in European country. In 2012, 21.2 million metric plenty of municipal solid waste was collected in European country (MAGRAMA two014), within which eighty fifth of solid waste corresponds to mixed waste. Then this can be treated in several plants with the aim of ill materials for his or her later use and therefore the transformation of the perishable organic fraction into compost and biogas. However, the whole quantity of fabric processed in these plants, 42.2% is rejected. In 2012, only 13.57% of the whole quantity of the rejected material was processed in these plants. the remainder was deposited in landfills. Therefore, a major quantity of the fabric is rejected the aim of this work is to research, on the one hand, the P.E. recovery of the fabric rejected from the municipal solid waste plants in energy recovery plants, by finding out the energy potency of the present plants. On the opposite hand, it'll additionally compare completely different energy valorization technologies so as to research the necessity for brand spanking new Waste-to-Energy plants to require advantage of all the rejected biofuel material generated in European country.

Murphy,J.D and Mckeogh,E (2004) has studied regarding Technical, economic and environmental analysis of energy production from municipal solid waste. during this study technologies area unit examined that manufacture energy from municipal solid waste area unit incineration, chemical process, generation of biogas, usage during a combined heat and powerhouse, generation of biogas and alter to move fuel.

Osei-Appaiah Nana Ama (2019) has studied on Techno-Economic Assessment of Waste to Energy Technologies in Republic of Ghana. to scale back environmental degradation and improve energy security in Republic of Ghana, waste-to-energy technologies can play a key role. This paper assesses the feasibleness of municipal solid WtE technologies in Republic of Ghana victimisation national capital as a case study. Technical feasibleness, economic feasibleness, and barrier analysis are administrated to assess the feasibleness of municipal solid WtE conversion technologies. an influence generation potential (PGP) of 530 kW/tMSW associate

degreed an energy recovery potential (ERP) of forty one.68 kWh/tMSW is recoverable from the waste in national capital once organic chemistry energy conversion is applied associate degreed a PGP of 1320 kW/tMSW and an ERP of 106 kWh/tMSW is recoverable once thermochemical energy conversion is applied. The barrier analysis suggests that the most hindrance to the preparation of WtE technologies in Republic of Ghana is that the high direct value.

Pablo Emilio Escamilla-García and Raúl Horacio Camarillo-López et al (2020) are reviewed concerning Technical and economic analysis of energy generation from waste burning in United Mexican States. during this paper they evaluated the likelihood of energy generation by combustion of waste in United Mexican States. The population of United Mexican States was split into six population-size categories, every one associated to a waste generation index. the full quantity of waste and also the lower hot values were wont to estimate the facility and energy ensuing from every size category. The economic practicableness was evaluated victimisation the Levelized price of Energy (LCOE), web gift worth (NPV) and Internal Rate of come (IRR). For population up to three million inhabitants the burning of waste resulted in fifty eight.9 MW. the full energy generation resulted in eleven,681.64 GWh contributive to four.3% of the national demand. A sensitivity analysis was conducted, addressing specific components of the analysis to point out however the project will become economically possible once adjusting investment, O&M and sales tariff. This analysis provides proof on however the Waste-To-Energy (WTE) combustion trade is possible in United Mexican States and provides vital advantages, not solely by strengthening the renewable energy sector however conjointly by considerably up the waste management system.

Paulina Wien Chol et al (2020) worked on Waste-to-energy technology integrated with carbon capture – Challenges and opportunities. greenhouse gas unharness maybe a serious environmental issue that people in general area unit should face. one in every of the promising technologies for reducing international CO2 emissions is oxy-fuel combustion (OFC) technology, that belongs to the carbon capture ways. OFC involves the utilization of chemical element associate degreed recirculated flue gas as an oxidizing agent within the combustion method. Application of oxy-fuel combustion in waste combustion may result in negative CO2 emission since some a part of the

carbon in municipal solid waste is biogenic. Such technology is commonly delineate as BECCS or Bio-CCS and it's attracted the eye of scientists recently. additionally to easier CO2 capture, oxy-fuel combustion of municipal solid waste offers different benefits, like reduced flue gas volume, enhanced combustion temperature and therefore the risk of retrofit existing combustion plants. within the gift paper, studies of oxy-fuel combustion of waste materials, above all, municipal solid waste and waste material sludge area unit bestowed and summarized. The study shows the opportunities and challenges that need to be self-addressed to completely exploit the potential of the oxy-fired combustion plant.

Stephen Burnley et al (2011) has studied regarding Energy implications of the thermal recovery of perishable municipal waste materials within the uk. Waste management plans and legislation in several developed countries entail a discount within the amount of perishable waste landfilled. Anaerobic digestion, combustion and chemical change area unit choices for managing perishable waste whereas generating renewable energy. However, little analysis has been administrated to ascertain the energy balance of the gathering, preparation and energy recovery processes for various kinds of wastes. while not this data, it's not possible to see the optimum methodology for managing a specific waste to recover renewable energy. during this study, energy balances were administrated for the thermal process of waste, garden waste, wood, paper and therefore the non-recyclable fraction of municipal waste. There was additionally very little reliable data on the performance and potency of anaerobic digestion and chemical change facilities for waste. However, we have a tendency to known a scarcity of reliable data on the energy consumed in grouping individual wastes and getting ready the wastes for thermal process.

Suraiya Yasmin and Md Imranur Rahman (2017), This study review of Solid Waste Management follow in capital of Bangladesh town. Waste management could be a stimulating task because of population is increasing and kind of waste is dynamical. Waste management follow desires concern for its generation increasing and inadequate follow. The waste generation rate is increasing because of increasing rate of population in capital of Bangladesh town wherever a reparable waste follow is needed to develop. This criticism can summaries the recent year’s state of waste

generation and management practices. The review reveals that the uncollected wastes area unit drop in open areas and streets that clog the system making serious hazards, environmental degradation and health risks within the town. Awareness on varied aspects of waste management will facilitate reduce waste generation and improve waste management method.

Wajeeha Anum Qazi and Mahound F M Abushammala (2020) has studied multi criteria call analysis of waste to energy technologies. This arcticle shows that the fast increase within the generation of solid waste and rising demand for energy and preservation of fossil fuels worldwide caused a rise within the quality of waste to energy technologies because the answer for waste management issues and energy demands. WTE technologies convert the waste to energy and minimize the number of waste sent to landfills, that additionally reduces negative impact on close surroundings.

This chapter presents the method and specific aspects of WTE technologies together with their blessings and downsides. It additionally discusses the vital criteria concerned to pick out and guarantee economical operation of WTE technology. This chapter proves that the waste and method should closely match to realize correct conversion of waste and higher potency of a WTE technology. in style multi-criteria decision-making techniques square measure mentioned during this chapter, as they need the aptitude to resolve a fancy call downside of choosing the correct WTE technology that involves several factors.

Wei Gu and Di Liu et al (2021) worked on Energy recovery potential from combustion victimisation municipal solid waste supported multi-scenario analysis in national

capital. The rapid climb of municipal solid waste (MSW) generation, waste-to-energy (WTE) combustion has gained quality thanks to its potential for electricity generation and fleetly reducing the quantity and mass of MSW. This paper makes an attempt to require into consideration the various levels of MSW supply separation likewise because the impact of various MSW compositions on energy recovery potential from combustion. we have a tendency to assume that the MSW management level in national capital in 2025 can reach that of developed countries (e.g., Australia), that have pr expertise and mature MSW management systems. They established six

eventualities and differentiate them by the composition and lower heating values (LHV) of MSW, thought of with and while not utilization and supply separation to variable degrees. the expected quantity of MSW generation in 2025 is eleven,505,400 tons with a pair of.255% mean absolute proportion error (MAPE). The results not solely offer implications for equalization the advantages and prices of implementing WTE combustion methods however additionally shed light-weight on government management of MSW supply separation.

Woch et al., (2015) has conducted a case study of 1 forest division of Polska. the target was to see the potential of forest woody waste biomass as a supply of renewable energy and therefore the findings show that energy output would permit energy for big range of individuals.

CHAPTER-3

RESEARCH GAPS OF EXISTING METHODS

Our research gap about the matter of generating electricity using dry & wet waste management Is this waste management explores of innovative technologies and also great & unique idea of the strategies to conduct the collection, sorting, and recycling processes. By understanding this process we can know about the waste management and also understanding environmental And economical impacts of huge dumps of waste seen on the areas in our country by using advanced technologies we can solve this problem of waste management that IOT includes in this solution this research could contribute to more sustainable and efficient waste management practices, and also by addressing this problem

3.1 Improving city by using waste management

For implementing most efficient waste(garbage) management systems and functions, such as the process of recycling the waste system programs and also the composting and converting that compost to the biogas form through the dry & wet waste can significantly improves the City's nature [1]. This not only used for reduction of the environmental impacts but also to create job opening opportunities for the needy people so they can live the life in good way in this waste management sector. Additionally by using this method in every rural and urban areas we can educate people and responsibilities about the waste disposal plays a vital role in the areas and we can built a cleaner, healthier development in our India

Research papers [1] Allwin Jose, Alan D'souza, Sarvesh Dandekar, Jitesh Karamchandani, Pavan Kulkarni, Air Conditioner using Peltier Module, 2015 International Conference on Technologies for Sustainable Development as our research of this paper that they have included bin detection identification when the bin got full it will send the message to the nearest garbage collector so they will come and collect the garbage from the bins but in our project we don't have that objective [2] akafumi Hatano, Mingcong Deng, and Shin Wakitani, A Cooling and Heat-retention System Actuated by Peltier Device Considering Fan-motor Control, 2014 IEEE International Conference on Automation in this paper as our research they didn't included the how much voltage produced by the dry and wet waste but in our project we have included that objective

[3] Saket Kumar, Ashutosh Gupta, Gaurav Yadav, Hemender Pal Singh, Peltier Module for

Refrigeration and Heating using Embedded System, 2015 International Conference on Recent Developments in Control, in our research about this paper was like they didn't included the big gas conversion to electricity but we have included in our project.

V. Soundharya et al proposed Smart Waste Segregation and Monitoring System using IoT. In this paper, 3 types of waste namely dry, wet and metallic wastes' segregation is described. This takes place with the help of sensors. [4]. Swati Sharma et al have proposed a "Smart dustbin management system" Here, dustbins are equipped with low-cost smart devices and they have been placed in all four directions. Those devices can be monitored by the employee and admin of the system so that undesirable flow of garbage is avoided. [5]. Shyamala S.C et al have proposed a "Smart Waste Management System". In this paper, traditional waste management system was upgraded by inserting smart sensors to gather the data and the condition of garbage present in the bins. Server receives this data and processes it is being discussed.[6]. Bhupendra Fataniya et el proposed a work on "Implementation of IoT based Waste segregation and Collection system"They have considered three basic entities such as sensing nodes, cloud and mobile application. The sensing nodes includes ultrasonic sensor, moisture sensor and gas sensor. Ultrasonic sensor provides the value of the distance available in the bin.[7]. Sivasankari et al proposed "Smart Waste Management Using WSN and IoT". In this method Waste is collected as usual. Sensors are deployed on the bins which are networked together using Wireless Sensor Network (WSN) to collect waste from the bins [8]. Prof. S.A. Mahajan et al have proposed "Smart Waste Management" In this paper, public garbage bins are attached to a device which monitors the level of garbage in the bins is discussed. [9]. Teoh Ji S et al proposed An Internet of Things Based Smart Waste Management System Using LoRa and Tensor-flow Deep Learning Model. Here, LoRa to send the sensor data and Tensor-flow for object classification are used for waste segregation along with Raspberry Pi [10]. G U Fayomi et al in Smart Waste Management for Smart City: Impact on Industrialization propose the use of artificial intelligence (AI) to solve waste management such as convolutional neural network for efficient classification and waste identification and other AI technology presenting a review of the technologies involved in implementing smart management. In order to satisfy the area of environmental safety, an in-depth study of each element is taken into account.[11]. Dattatray Waghole et al in Smart Bin for Waste Segregation and Energy Generation using IoT propose a smart bin that can notify the municipality at various phases of waste disposal. When it exceeds 30%-60%, it generates an alarm to the garbage collector assigned to the region. When the proportion reaches 90%, a

warning will be issued to the necessary officials.[12].

3.2 Research gaps of existing methods

NAME	IOT based Smart bin for cities	Efficient garbagedisposal management in metro Politian	Smart dust bin	Smart bin implemented for smart city
Bin measurement	YES	YES	YES	YES
Object detection around bin	NO	NO	NO	NO
Measuring number of watts produced	NO	NO	NO	NO
Time consumption to generate electricity	NO	NO	NO	NO

CHAPTER-4

PROPOSED MOTHODOLOGY

4.1 Flow of project

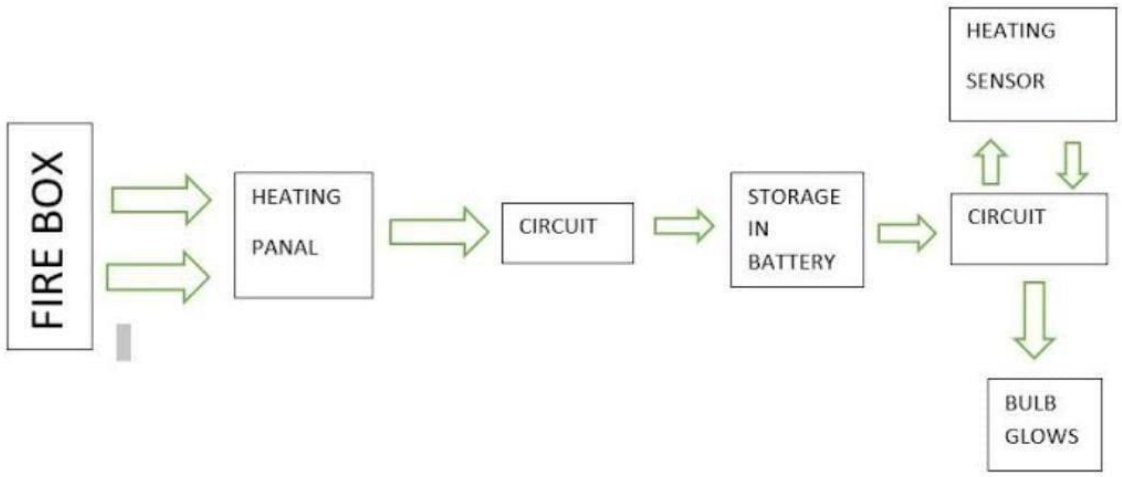


Figure 4.1 Flow of project

In this flow of project system, the bins were used to store dry and wet waste, these bins are replaceable for cleaning purposes. The waste of separated dry and wet waste is placed on the moisture sensor. The moisture sensor will detect the moisture. if its wet then it will fall into the right side of bin its dry then fall into the left side of bin This senses the moisture content; the relay helps in the rotation of the servo motor in both clockwise and anticlockwise directions hence it moves waste into its respective bins. The Distance sensors are used to know the level of the garbage in the bin. All the sensed data from Arduino UNO using sensors. When we burn waste materials , then convert heat to electricity and LED bulb glowing by electricity for showing electricity power ,After that circuit take electricity and give to battery, And waste materials burning running in compost system box , and there is heating sensor and when heating sensor is heated by heating ,Then Heating sensor turn On the LED bulb, (Because Heating sensor work as a on/off switch). After that You can See Full successfully Generating Electricity by Waste Material. This is the flow of the project

Block diagram for working of generating electricity:

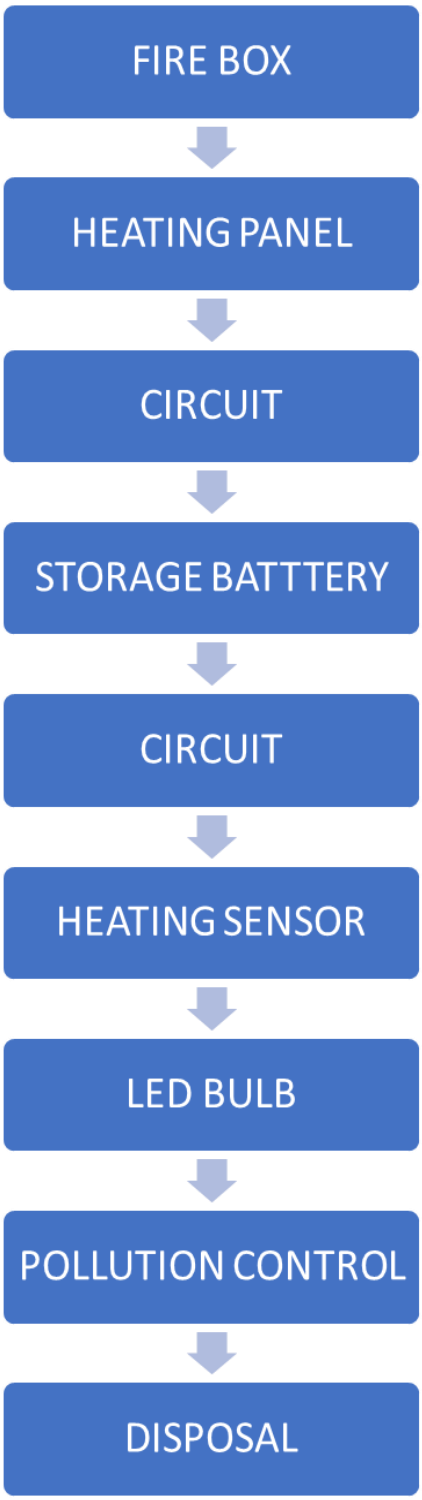


Figure 4.1.2 block diagram of working

PRODUCTION

Waste-to-energy facilities tend to be constructed near the landfills of large urban centers. A few conveniences are modular units, smaller plants built off-site and transported to wherever they are needed. Waste-to-energy plants generate electricity by burning municipal wastes in large furnaces to produce steam, which in turn drives a steam turbine to generate electricity. On average, one ton of waste produces 525 kilowatt-hours (kWh) of electricity. This is equivalent to the energy produced by a quarter-ton of coal or one barrel of oil. One type of waste-to-energy plant is called a mass burn facility .These facilities use solid waste directly off garbage trucks, without shredding or processing the materials. The solid waste is then fired in large furnaces to produce steam, which turns a steam turbine to generate electricity. Less than a fifth of the U.S. municipal solid waste incinerators recover glass, metals and other recyclable materials and then shred the combustible materials before firing. This type of plant is called a refuse-derived fuel (RDF) plant. Sometimes, refuse-derived fuel is prepared at one facility and then transported to another for burning. The shredded waste also may be added as a fuel to boilers that burn fossil fuels. Mass burn and RDF plants are the most common facilities in use today. A new technology called thermal gasification, however, changes waste into synthesis gas, a mixture of hydrogen and carbon monoxide. Contaminants are removed from this gas, which can then be burned as fuel. .A typical waste-to-energy plant generates about 500 to 600 kWh per ton of waste.

STORAGE AND AVAILABILITY: The energy or hot gas produced by waste-to-energy plants is not stored. It is used to produce energy, either to sell to an electric company or business or to produce steam for other purposes. The nation's 87 waste-toenergy facilities are mostly located in the Northeast, but 25 states have at least one. Their generating capacity is a total of 2,720megawatts of power, enough electricity to power all the homes in Maine, New Hampshire, Vermont, Rhode Island and most of Massachusetts. They can process 28.7 million tons of waste each year. Most sites burn all types of solid waste, but some burn material separated from the main waste stream, such as tires, wood or paper. According to a Columbia University survey published in Bio Cycle magazine, the U.S. generated about 388 million tons of municipal solid waste in 2004. Of this amount, about 28.5 percent was recycled and composted; about 7.4 percent was burned in waste-to-energy plants; and the majority

Waste Distribution Model

This phase is demonstrated by MCCWM, in which geographical information and demographic information are provided. All government resources are available in the central city. Based on the population of each municipality around the city and the density of districts in each municipality, MCCWM estimates and provides an adequate amount of equipment, including waste collection trucks and trash bins for each municipality. MWMC also calculates the required amount of equipment for each district based on the waste source locations. Examples of waste source sites are homes, supermarkets, groceries, bakeries, restaurants and others, as previously presented in

A smart bin is proposed in this paper to support waste collection and provide a healthy environment. Each smart bin and truck includes the following gadgets: ultrasonic, Arduino, GPRS and GPS connected through the cloud server. In addition, the application is used for monitoring and interacting with the system after the action has been done. **Figure 10** presents an example of small gadgets/devices together with a web-based system that permits the combination of the IoT as a new-generation technology.

Integrated technology devices/applications.

The system plans to test the previously available waste management system and gather the information to perform a more optimized waste management system. The system not only informs about the smart bin scale but also notifies the worker working on it. It will assist domestic corporations, government organizations as well as people who still utilize manual ways of gathering garbage from trash bins.

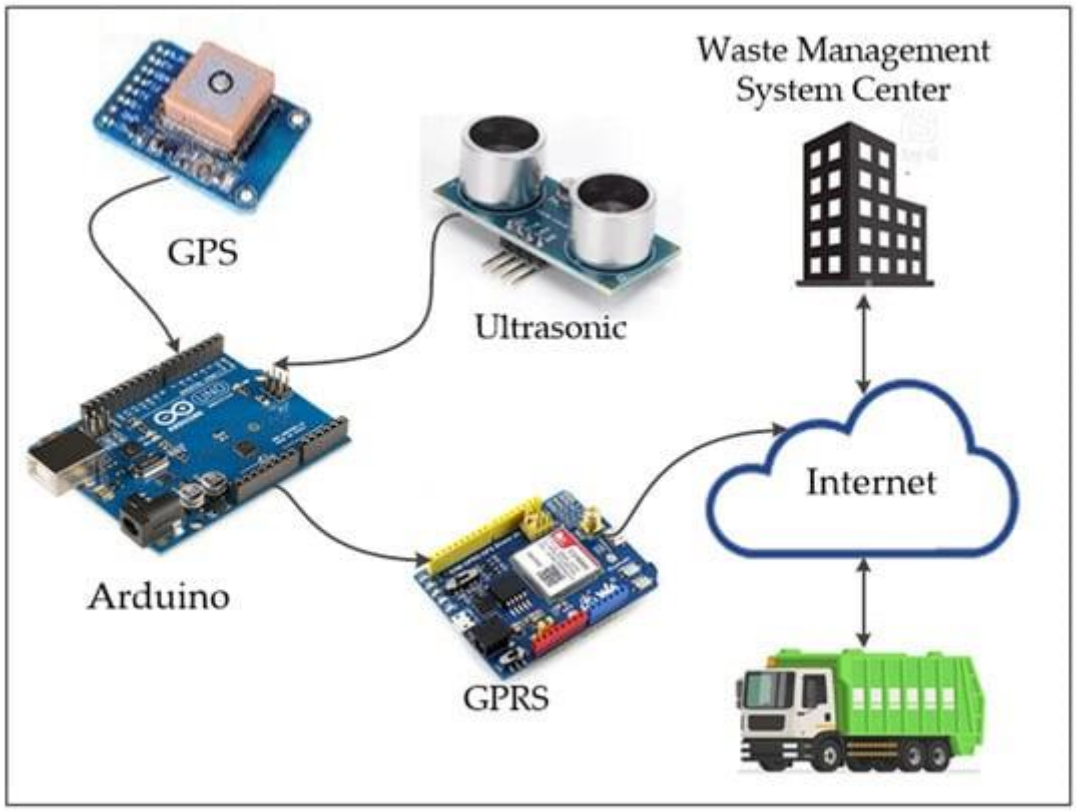


Figure 4.2 waste Distribution model

However, as shown previously, households in KSA generate more waste food compared with food services and retail than in other countries, referencing that it should pay more concern to all the resident's service locations, including the open public area and the historical area.

4.3 Architecture for segregating Dry and wet waste

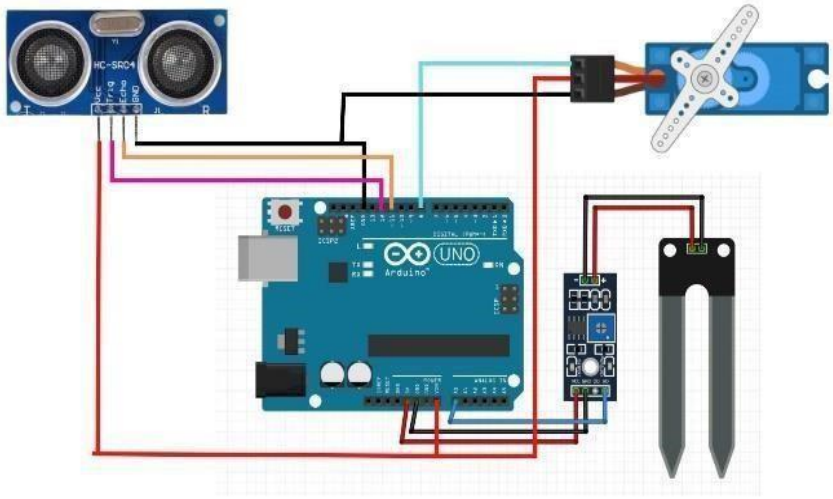


Figure 4.3 Architecture for segregating dry & wet waste

The ground pin of ultrasonic sensor and servo motor sensor is connected to the ground of Arduino uno r3 the echo pin and the trig pin is connected to 12 and 13 to Arduino and the Vcc is connected to 5 volts of Arduino uno r3 board servo motor pin connected to 8 in Arduino uno r3 servo motor vpin is connected to Arduino uno r3 soil moisture sensor A0 is connected to A0 in Arduino uno r3 soil moisture sensor gnd is connected to Arduino uno re gnd vcc is connected to 5 volts in Arduino uno r3 after the connections by using soil moisture sensor that sensing of that dry and wet waste the nature of soil moisture sensor to detect the dry and wet so the dry waste falls to the right side and wet waste is falls to the left so this is the segregating dry and wet waste.by using the Arduino IDE software we will insert the logic and code to this Arduino uno r3 project so after inserting the code without errors next port should be applied in Arduino ide the port called com.11 port used and code and logic will be applied so the successful working of code leads to the successful working of the .

4.4 Architecture for Generating electricity using waste

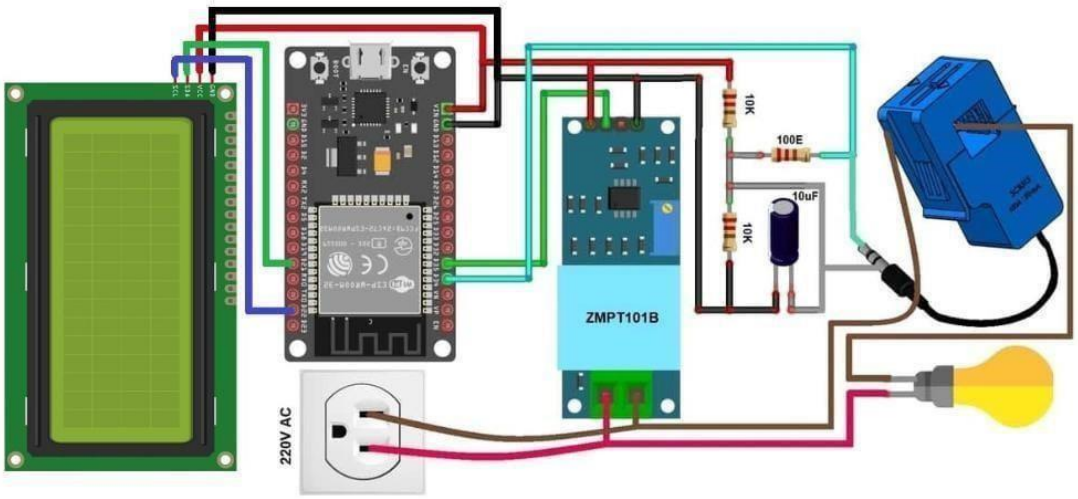


Figure 4.4 Architecture for Generating electricity using waste

Arduino Nano Connect the Arduino Nano to your computer for programming. Utilize the Nano's digital pins for sensor, relay, switch, and LED display connections .Heating Sensor Connect the heating sensor to one of the analog pins on the Arduino Nano. Ensure proper power (VCC and GND) connections for the sensor. LED Display Connect the LED display to digital pins on the Arduino Nano. Make sure to connect power (VCC and GND) appropriately. Relay Connect the relay module to a digital pin on the Arduino Nano. Connect the relay module's control input, typically labeled IN, to the chosen digital pin. Connect the relay module's common (COM) and normally open (NO) terminals to control the bulb. Switch Connect one terminal of the switch to a digital pin on the Arduino Nano. Connect the other terminal of the switch to the ground (GND) on the Arduino Nano. Bulb Connect one end of the bulb to the common (COM) terminal of the relay. Connect the other end of the bulb to the power source. Battery Power the Arduino Nano, sensor, and switch using the battery .Connect the positive (VCC) and negative (GND) terminals to the appropriate pins on the Arduino Nano This setup allows you to manually control the state of the relay using the switch, in addition to the automatic control based on the heating sensor readings.

CHAPTER-5

OBJECTIVES

5.1 Objectives

1. Segregation of dry and wet waste.

The main objective is to automate & separation of dry and wet waste of the whole garbage

Many people have lesser knowledge about what is wet and dry waste

2. displaying of flame detected or not detected.

In our project displaying of flame detected or not detected is the another objective that implements the while we are burning compost it's a safety measure that we included to check weather the flame is detected or not detected on the composter system so we can start the burning of compost dry & wet waste

3.The amount of voltage/electricity produced in such bulb after segregation of production of voltage obtained by dry and wet waste

and coming to another objective that how much voltage produced by the dry waste and also the wet waste through the burned compost that converted to biogas that will converted to the electricity and will generate bulb to glow This project aims to explore sustainable energy solutions, reduce environmental impact, and optimize the production process for generating electricity from waste materials to illuminate bulbs.

CHAPTER-6

SYSTEM DESIGN & IMPLEMENTATION

6.1 S/w and H/w requirements

Software requirements

Arduino IDE(1.8.19) software

About software

Arduino IDE full form (Integrated development environment) is an open source software for the IOT sensor applications of huge projects and is used for the hardware project and Arduino board will be connected to the laptop and programming and uploading code to Arduino boards. It will provides a interface for writing, compiling, and uploading code to project of the IOT this is all about the Arduino ide software

Hardware requirements of generating electricity using waste

Figure 6.1 lcd display

it provides visual feedback or information of real data sensor readings other info from Iot devices

Figure 6.1.1 Batteries

Batteries are classified into primary and secondary forms: Primary batteries are designed to be used until exhausted of energy then discarded.

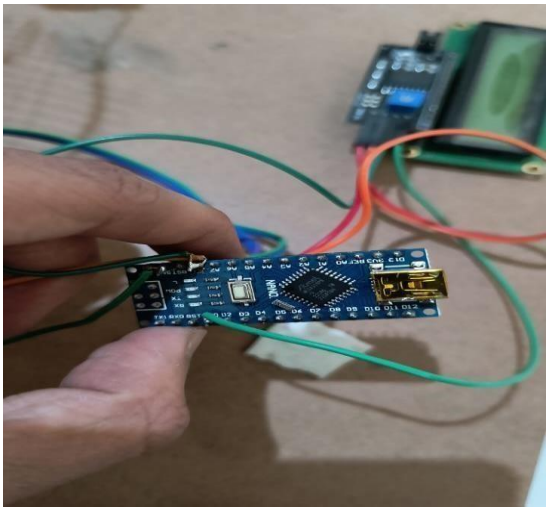
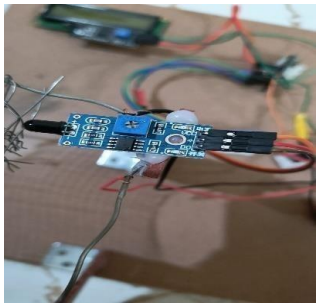


Figure 6.1.2 Arduino nano 3.x

small and versatile and micro controller board 8.0.19 which provides digital and analog I/O pins The Arduino Nano is equipped with 30 male I/O headers, in a DIP-30-like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9 V battery.

Figure 6.1.3 I2C module



(inter integrated circuit) it is a serial communicated module that will allows to the low-speed connections to communicate through the module is called I2Cmodule

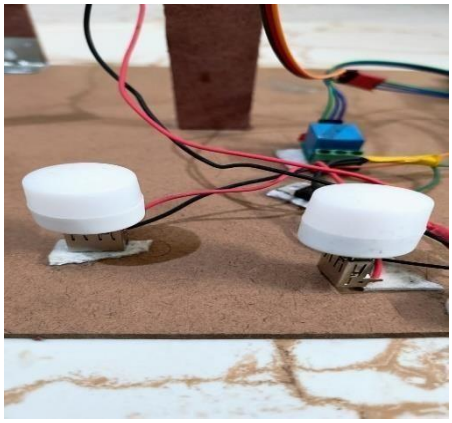


Figure 6.1.4 Led Bulbs

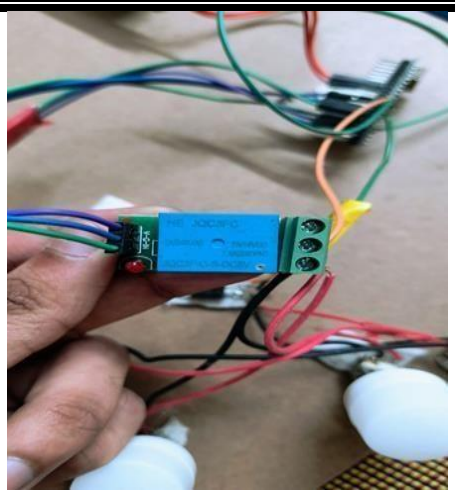


Figure 6.1.5 Relay

Relays allow you to controls with the high-power to low-power connected systems in the

Figure 6.1.6 Servo motor

A servo motor is a rotary actuator that actually rotates as the angular directions in directions like 60degree,80degree,120degree and etc.

Figure 6.1.7 Ultrasonic sensor

Ultra sonic sensor is an instrumental that will measures the distance of an objects

Figure 6.1.8 Soil moisture sensor

Soil moisture sensor detects the nature of the object as dry or wet

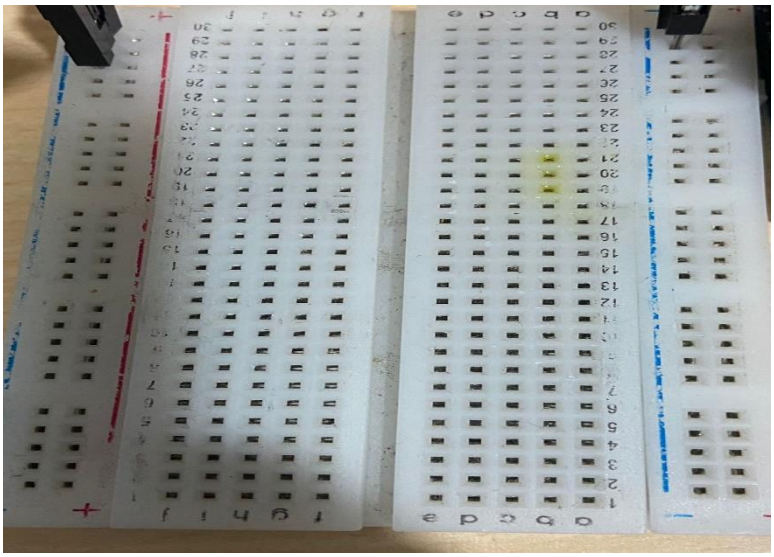


Figure 6.1.9 Breadboard

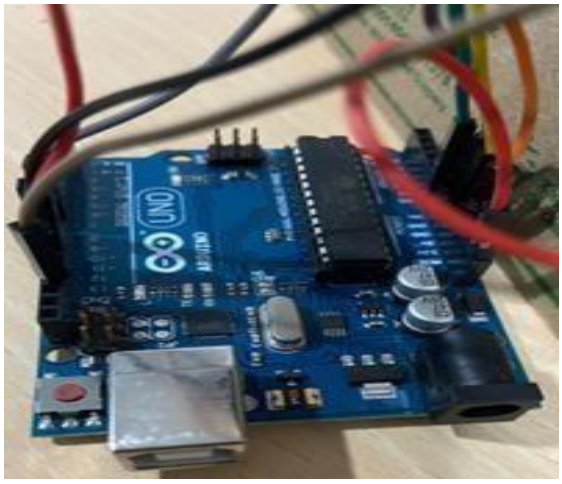


Figure 6.1.10 Arduino uno r3

4.2 Specifications of H/W components Table

4.2.1Details of hardware components

Sr No.	Component Name	Specifications	Quantity	Price per Item	Total Price
1	Lcd display	Displays the characters	1	200	200
2	Batteries	Batteries used to store the biogas generated through the waste &used later	2	50	100
3	Arduino nano	Used to connect the small pins through the I2Cmodule and led bulbs etc	1	209	209
4	I2c module	**(** inter integrated circuit) that connect low speed devices	1	215	215
5	relay	Relays allow you to controllow-powered signals from devices such as Arduino	1	40	40
6	Servo motor	the presice control of angular and linear positions of a system	1	170	170
7	Ultra sonic sensor	Used to rotate in angular motions	1	190	190
8	Soil moisture sensor	nature of the object as dry or wet	1	150	150
9	Bread board		1	100	100
10	Arduino uno	program &upload code to the application	1	700	700
11	Led bulbs		2	40	80
Total Price of IOT Prototype in Rupees				**2154**	

6.3 System design for segregation of waste

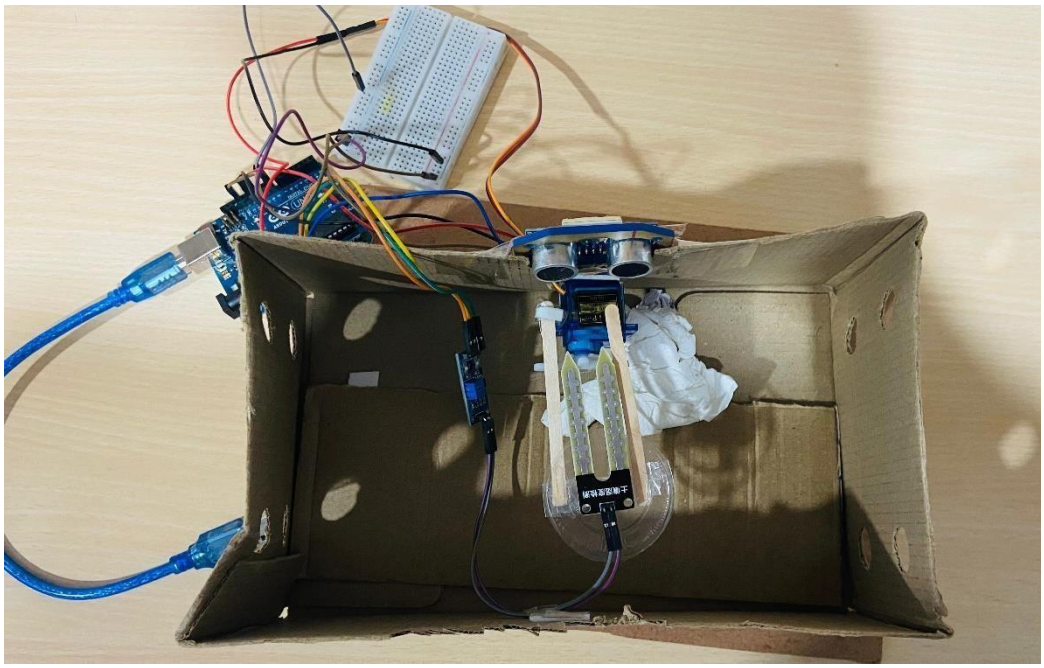


Figure 6.3 Hardware system design of segregating

In this project we have tried to integrate our normal dustbin with IOT so that we can segregate wet and dry garbage, and it will also indicate whether the garbage is full or not on the website. Here we are using Arduino UNO, along with 1 ultrasonic sensor, 1 servo motor, 1 moisture sensor, and jumper wires.Connect the servo motors, ultrasonic sensors, moisture sensors and to the Arduino uno Upload the code to Arduino uno using Arduino use the dustbin , a person needs to press the push button and keep his/her waste on the plate fixed on the servo motors for setting up soil moisture sensor with Arduino using LM393 comparator. In this project we need to connect only 3 pins of LM393 comparator with Arduino i.e. Vcc ,GND, AO after the connection the working of that segregation is done through the servo motor and ultrasonic sensor and soil moisture sensor once we place the waste on the top of the soil moisture sensor it will detect dry or wet then it will segregate dry waste fall on the right side then wet waste fall on the left side so it will be segregated through the soil moisture

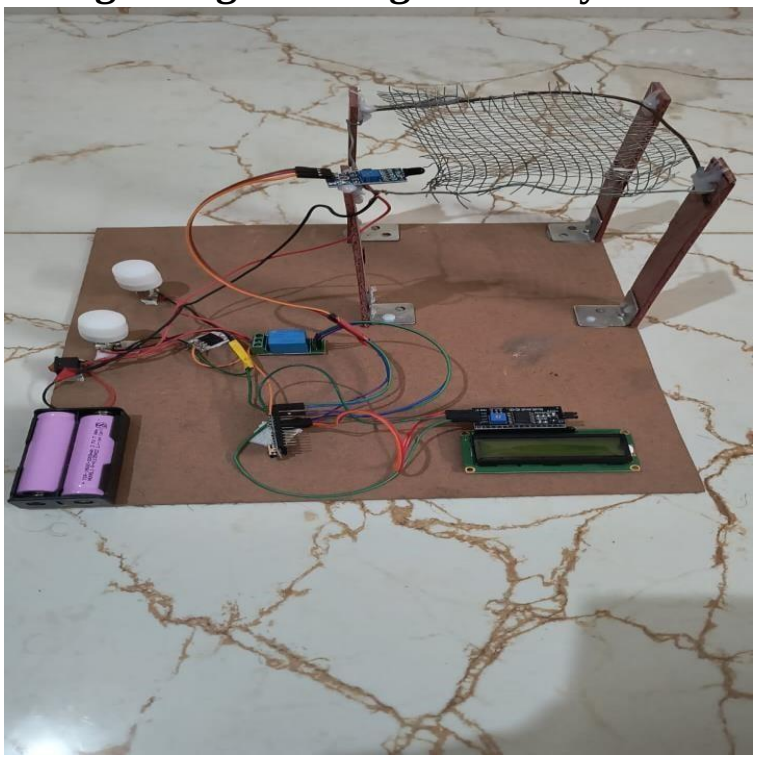
The smart garbage bin will incorporate moisture sensors and ultrasonic sensors to detect the p resence of wet and dry waste, respectively. The moisture sensors will be used to detect the m oisture content of the waste, while the ultrasonic sensors will be used to measure the distance

between the top of the waste and the top of the bin. This will allow the bin to detect the prese nce of waste and estimate the level of fill.

In addition, the bin will be equipped with Bluetooth connectivity, which will allow remote m onitoring and management. This will enable waste management companies to monitor the bi n's fill level, as well as its location and status in real-time. The bin will be designed to be rug ged and durable, with a capacity of at least 50 litters to accommodate large volumes of waste . A prototype of the smart garbage bin will be developed using off-the-shelf components, suc h as Arduino boards, sensors, and communication modules. The prototype will be tested to e nsure that the sensors are functioning correctly and that the Bluetooth connectivity is reliable and robust. The prototype will also be evaluated for its durability and ease of use. To evaluat e the performance of the smart garbage bin, data will be collected on the types of waste that a re being disposed of, as well as the moisture content of the waste. This data will be analysed t o determine the accuracy of the moisture and ultrasonic sensors in detecting wet and dry was te. The data will also be used to identify any trends or patterns in waste disposal. To test the Bluetooth connectivity of the smart garbage bin, a mobile application will be developed that can communicate with the bin. The application will be tested to ensure that it is able to receiv e data from the bin and send commands to it. The Bluetooth connectivity will be tested in dif ferent scenarios to ensure that it is reliable and robust.

After the prototype has been developed and tested, field testing will be conducted to evaluate the performance of the smart garbage bin in real-world conditions. This will involve deployi ng the bin in a variety of settings, such as public parks and residential areas, and monitoring i ts performance over a period of several weeks. Data will be collected on the types of waste th at are being disposed of, as well as the moisture content of the waste. This data will be analys ed to determine the accuracy of the moisture and ultrasonic sensors in detecting wet and dry waste. Once the field testing has been completed, the data collected will be visualized and an alysed. This will involve developing charts and graphs to visualize the types of waste that are being disposed of, as well as the moisture content of the waste. A report will then be prepare d, which summarizes the findings of the research and testing, and provides recommendations for further development of the smart garbage bin

6.4 System design for generating electricity



6.4 Hardware system design of generating electricity

In this system, a flame sensor positioned near the combustion source detects the presence of a flame, relaying this information to an Arduino Nano through a designated pin. The Arduino program interprets the sensor data, activating an LED for visual confirmation and simultaneously displaying relevant messages such as "Flame Detected" or "No Flame" on an LCD display.

The Arduino also controls a relay, ensuring that the electricity generation process, represented by a connected generator, is initiated only when a flame is detected. This setup enhances safety by preventing the generator from operating in the absence of a flame.

The logic in the Arduino program incorporates checks and delays to mitigate rapid on/off switching due to minor sensor fluctuations, providing a stable and efficient electricity generation system responsive to the flame sensor input. And also in this after the combustion of the dry and wet waste that the biogas will be converted into the electricity and the external biogas will be stored into the batteries and the used to the further level of generating electricity and then when we on the switch that switch connected to batteries after on the switch then the batteries will produce the stored biogas and generates the electricity through the burned waste of dry and wet.

KINDS OD WASTES TO BE BURNED:

SIZE OF WASTE CONSTITUENTS:

The size distribution of waste ingredients at intervals the waste stream is significant as a result of its consequence at intervals the design of mechanical separators and device and waste treatment methodology. This varies wide and whereas coming up with a system, correct analysis of the waste characteristics has to be compelled to be distributed.

MOISTURE CONTENT:

The relation of the load of water to the complete wet weight of the waste is made public as condition content. condition is directly proportional the load of solid wastes, and thereby, the value of assortment and transport. condition content is also an important determinant at intervals the economic risk of waste treatment by burning, as a result of wet waste consumes energy for evaporation of water and in raising the temperature of water vapor. at intervals the most, wastes have to be compelled to be insulated from downfall or completely different extraneous water. A typical vary of condition content is twenty to ordinal, representing the extremes of wastes in academic degree arid climate and at intervals the wet season of a part of high precipitation. However, values larger than ordinal are not uncommon. climate apart, condition content is sometimes higher in low-income countries as a result of the higher proportion of food and yard waste.

PHYSICAL CHARACTERISTICS

Information and data on the physical properties of solid wastes are necessary for the selection and operation of equipment and for the analysis and magnificence of disposal facilities. the following physical characteristics are to be studied intimately.

DENSITY:

The crucial have faith in the design of a solid waste management system is density of waste, i.e., its mass per unit volume(kg/m), e.g., the design of healthful landfills,

storage, styles of assortment and transport vehicles, etc. to clarify that academic degree economical operation of a lowland demands compaction of wastes to optimum density. ancient compaction instrumentality will do reduction seventy fifth in volume of wastes , which will increase academic degree initial density of 1 hundred kg/m3 to four hundred kg/m3. in numerous words, a vehicle that's aggregation waste can haul fourfold the load of waste in its compacted state than once it's uncompacted. necessary changes in density occur impromptu as a result of the waste moves from offer to disposal, due to scavenging, handling, wetting and drying by the weather, vibration at intervals the assortment vehicle and decomposition.

Heating process:

The separated solid waste which is collected for the project has been taken in the heating box for the heating process while heating the solid waste care should be taken the heating sensor is connected while heating process is going on the heating sensor and the heating panel takes the heat and converts that heat energy into electrical energy. The heating sensors, heating panels are used as like solar panels. It is the first and foremost process which is the main process in which the heat energy is converted into electrical energy. While doing this process care should be taken. The energy from this process taken by the heating panels and transfers that energy into the rechargeable battery through the circuits which helps to resists the flow of the current. The capacitors used to store the energy.

Natural fibres:

Natural fibres embody the natural compounds, cellulose, and lignin, that area unit proof against biodegradation. Natural fibres area unit found in paper and paper merchandise and in food and yard waste. The larger chemical compound of aldohexose is polyose whereas polymer consists of a gaggle of monomers of that aromatic hydrocarbon is that the primary member. Paper, cotton and wood merchandise contain 100%, ninety fifth and four-hundredth of polyose severally. solid waste containing high proportion of paper and wood merchandise, area unit appropriate for combustion. The hot values of overdried paper merchandise area unit within the vary 12000 – 18000 kcal/kg and of wood regarding 20000 kcal/kg, that

compare with 44200 kcal/kg for heating oil.

Synthetic organic material (Plastics):

Plastics area unit extremely proof against biodegradation and objectionable and of special concern in solid waste management. Therefore, the increasing attention being paid to the employment of plastics to scale back the proportion of this waste element at disposal sites. Plastics have a high heating worth, about 32,000 kJ/kg, that build them terribly appropriate for combustion. however one ought to note that polyvinyl resin, when burnt, produces hydrocarbon and acid gas. The latter will increase corrosion within the combustion system and is chargeable for acid precipitation.

Non-combustibles:

Non-combustible includes glass, ceramics, metals, dirt and ashes, and accounts for twelve – twenty fifth of dry solids.

Ultimate analysis:

It is outlined because the analysis of waste to see the proportion of carbon, hydrogen, oxygen, element and, and supreme analysis is finished to perform mass balance calculation for a chemical or thermal method. Besides, it's necessary to see ash fraction attributable to its doubtless harmful environmental effects, led to by the presence of cyanogenetic metals like atomic number 48, chromium, mercury, nickel, lead, tin and metal. One ought to note that alternative metals can also be gift however they're non-toxic.

Proximate analysis:

Proximate analysis is vital in evaluating the combustion properties of wastes or a waste or refuse derived fuel. The fractions of interest are:

- moisture content, that adds weight to the waste while not increasing its heating worth, and therefore the evaporation of water reduces the warmth discharged from the fuel

- ash, that adds weight while not generating any heat throughout combustion

- volatile matter, i.e., that portion of the waste that's born-again to gases before and through combustion
- fixed carbon, that represents the carbon remaining on the surface grates as charcoal. A waste or fuel with a high proportion of fastened carbon needs a extended retention time on the chamber grates to attain complete combustion than a waste or fuel with a coffee proportion of fastened carbon.

BIOLOGICAL PROPERTIES:

The organic elements are often born-again biologically to gases and comparatively inert organic and inorganic solids is that the most significant biological characteristics of the organic fraction of MSW. the assembly of odours and therefore the generation of flies also are associated with the perishable nature of the organic materials found in MSW.

Excluding plastic, rubber and animal skin elements, the organic fraction of most MSW is often classified as follows:

- soluble constituents like sugars, starches, amino acids, and numerous organic acids.
- Hemicelluloses, a condensation product of five- and six-carbon sugars
- polyose, a condensation product of the six-carbon sugar aldohexose
- Fats, oils, and waxes that area unit esters of alcohols and long-chain fatty acids
- Lignin, a chemical compound material containing aromatic rings with methoxy teams, the precise chemical nature of that continues to be not proverbial
- Lignocelluloses, a mixture of polymer and polyose
- Proteins, that square measure composed of chains of amino acids

Volatile solids content, determined by ignition at 550 0C, is usually used as a live of the biodegradability of the organic fraction of MSW. the employment of VS in describing the biodegradability of the organic fraction of MSW is dishonest, as a number of the organic constituents of MSW square measure extremely volatile.

CHAPTER-7

TIMELINE FOR EXECUTION OF PROJECT

(GANTT CHART)

Table 7.1 Timeline

S. NO	Review(Offline)	Dates
1	**Review-0**	**09-Oct-2023 to 13-Oct-2023**
2	**Review-1**	**06-Nov-2023 to 10-Nov-2023**
3	**Review-2**	**27-Nov-2023 to 30-Nov-2023**
4	**Review-3**	**26-Dec-2023 to 30-Dec-2023**
5	**Final Viva-Voice**	**08-Jan-2024 to 12-Jan-2023**

CHAPTER-8

OUTCOMES

The entire waste process, including level and separation, is monitored and controlled by configurable IO sensors, reducing open degradation of organic waste and thus the growth of Micro-Organisms. In the proposed system it divides the waste into dry waste, wet waste, and e-waste by using the color sensor In This Project we show How to Generate Electricity by waste materials is successfully and we show in project how to control pollution by this garbage management of eco-friendly management for generating electricity Cleaner and more efficient waste management Lower operational costs and reduced carbon emissions Electricity generation from waste Promoted recycling and community engagement Compliance with environmental regulations Potential economic opportunities .Waste Reduction and Efficient Management Reduced littering and optimized waste collection routes The system's real-time monitoring and dynamic route optimization lead to more efficient waste collection, reducing the overall volume of waste in public spaces and also by using this system we can reduce the wastage on the land areas of the city's and the areas of rural and urban areas as well . As compare to generating biogas through the burned compost it generate less pollution is a one of the thing in our project as well.

In the world the solid waste generation is increasing day by day everywhere.

In order to control that solid waste generation by controlling the pollution for the purpose of generation of electricity. In this project we show that how to generate electricity from solid waste successfully by the process of heating. We cannot control the pollution completely but we can control the pollution for up to some extent. We can generate electricity from solid waste by the process of heating and we can supply that electricity for the use In this project the generation of electricity from the solid waste by the heating process. These materials have been used for the generation of electricity by heating process by controlling the pollution by using the pollution filter. The filter has been setup in order to control the pollution while heating process has been going on. The results obtained after doing this process is analyzed and its efficiency for generating electricity.The existing system uses sensors to segregate the garbage into two types wet and dry. For the future work there should be addition of more segregation parts like metals and non-metals along with dry and wet also the system of making compost from wet and recycling of dry garbage will be added.

CHAPTER-9

RESULTS AND DISCUSSIONS

Every component as explained earlier is interfaced with Arduino UNO microcontroller. The representation of the whole

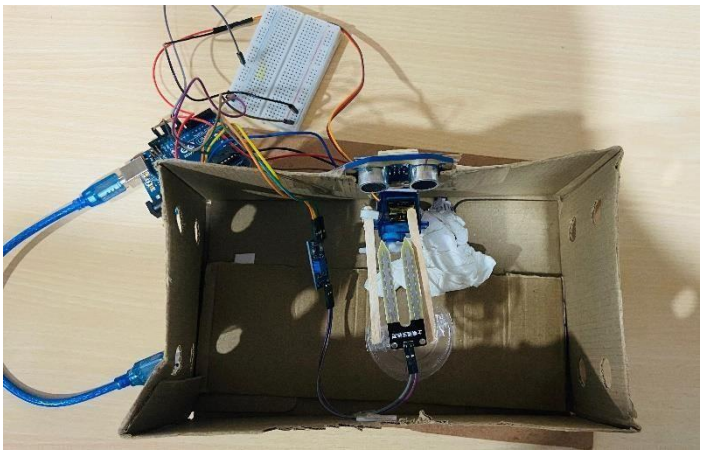


Figure 9.1 Assembling of segregation dry & wet waste

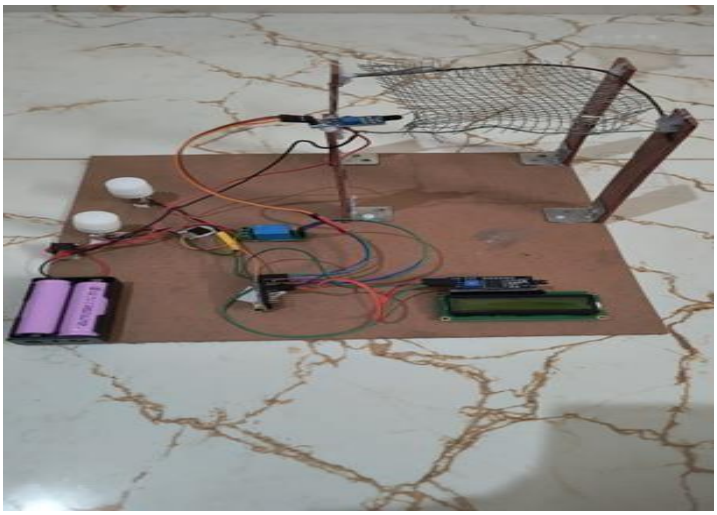
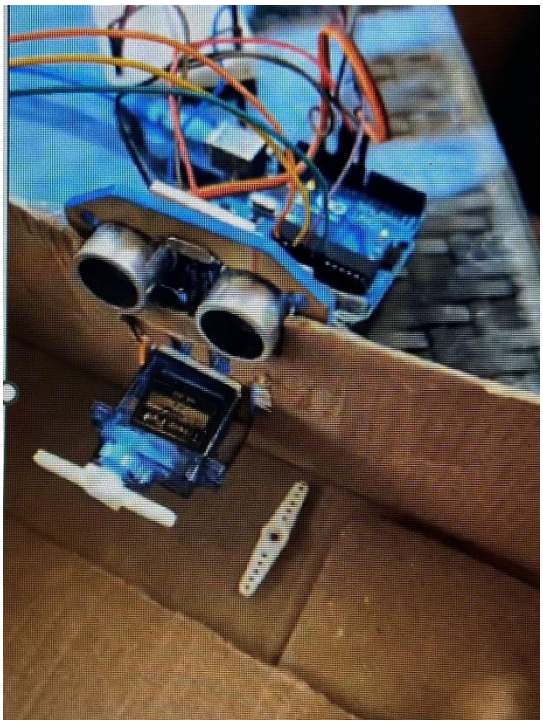
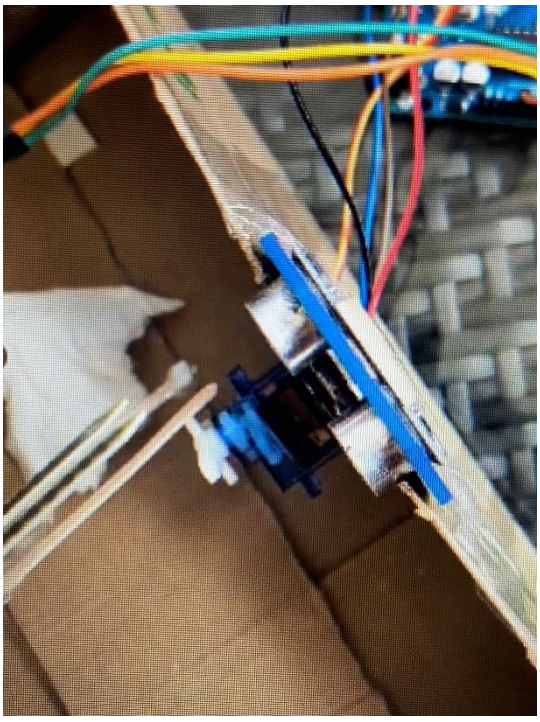


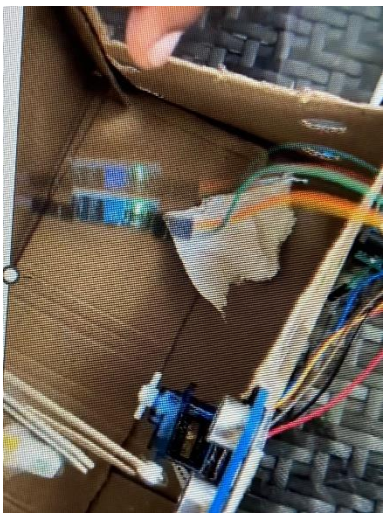
Figure 9.2 Before assembling



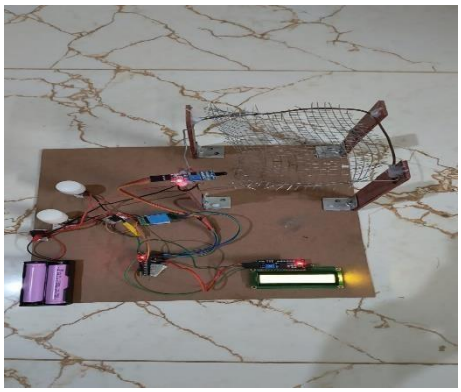
Servo motor working



Dry Waste segregated on right



Wet waste segregated on left



accurati.e.,accurately detecting the type of waste as it is thrown in the dustbin and dumping it into corresponding container.In this, we try to differentiate between different types of waste such as dry waste and wet waste.

Figure 9.3 After assembling

We use Arduino IDE software to program this system and results are found to be

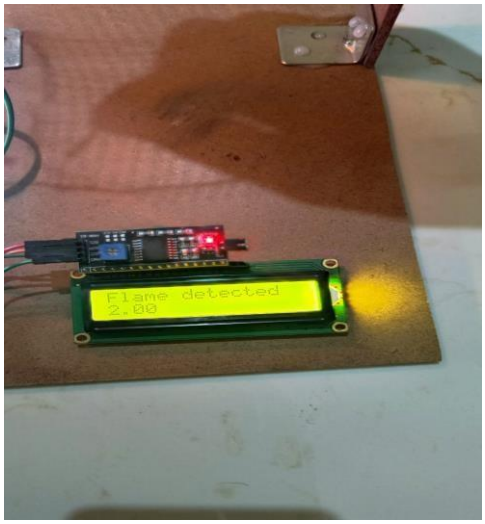


Figure 9.4 Flame detected & watts gene

Figure 9.5 Successfully electricity generated

CHAPTER-10

CONCLUSION

The Automatic waste management system may be a leap forward to create the manual assortment and segregation of wastes automatic in nature. The developed system would be work for dry wet waste management and segregation process. This method for the management of waste is very important and associate solution in this that the work for the people of municipality workers will be reduced to burn the ash and to generate electricity by using this automatic garbage management and generating electricity work will be reduced This automation of waste system process reduces the human effort and consequently the price of the entire method. This technique will be implemented at anywhere with ease and among affordable quantity of your time. The implementation prices for the automation are additionally reasonable. The general methodology for the detection and management of waste becomes economical and intelligent. We have shown the appliance and implementation of the above system.

In This Project we show How to Generate Electricity by waste materials is successfully and we show in project how to control pollution by this garbage management of eco-friendly management for generating electricity , When we making complete our project then we check it's full working ,that time its working is very good without any problem So our Project is best for working and it is ready to work , How to Generate Electricity by Waste materials .From this project we generate electrical energy from waste material with minimum pollution is about 50%.and also by using this system we can reduce the wastage on the land areas of the city's and the areas of rural and urban areas as well . As compare to generating biogas through the burned compost it generate less pollution is a one of the thing in our project as well.

The smart garbage bin that can detect dry and wet waste using moisture sensors and ultrasonic sensors and has Bluetooth connectivity has the potential to revolutionize the waste management industry. The use of innovative and technology-driven solutions can improve the efficiency and effectiveness of waste collection and disposal, reduce environmental impact, and promote sustainable development. Through this study, a smart garbage bin prototype was successfully designed and developed that accurately detects and classifies dry and wet waste using moisture and ultrasonic sensors. The accuracy of the smart garbage bin was tested for detecting different types of waste, including paper, plastic, food waste, and liquids, and it was

found to be highly reliable. The Bluetooth connectivity of the smart garbage bin was also evaluated and found to be robust and reliable for remote monitoring and management. The effectiveness of the smart garbage bin in improving the efficiency of waste collection and disposal was also analysed, and it was found that real-time data on fill levels and waste composition can help optimize waste collection schedules and routes, thereby reducing costs and improving environmental sustainability. The potential environmental impact of the smart garbage bin in reducing waste generation, promoting recycling, and improving waste management practices was also analysed, and it was found to have significant potential for improving sustainability in the waste management industry. However, there are also limitations and challenges in the design and implementation of the smart garbage bin, such as cost, power consumption, and potential technological issues. Therefore, future research and development are necessary to address these challenges and improve the design and effectiveness of the smart garbage bin. Overall, the development of a smart garbage bin that can detect dry and wet waste using moisture sensors and ultrasonic sensors and has Bluetooth connectivity is a significant step towards sustainable waste management practices, and it has the potential to make a positive impact on the environment and society.

The waste recycling system aims to collect the waste based on the waste type to improve the recycling management system and provide a healthy environment in addition to optimizing route transportation of waste gathering, according to GA.

The results show the number of sites of smart bins that require cleaning, including the other smart bins in the calculated route variant between Types 1 and 2, whereas Type 3 does not have any smart bins ready for collection. The simulation considers the different types of waste that have a different percentage of waste generation based on the waste source location.

The locations towards the urgent smart bin are calculated based on the GA. These locations include most of the urgent smart bins. The smart truck starts from the municipality center through the locations towards the urgent smart bin and collects the waste in the same direction. The urgent smart bins listed in the locations towards the target bin are skipped from the next truck travel for collection as the bin is already clean. Thus, after filtering the urgent bins from the collected bins, the number of locations to visit from the list of urgent smart bins is reduced, which results in reduced time consumption too

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APPENDIX-A

PSUEDOCODE

PSUEDO code for segregating of dry and wet waste

```
#include <Servo.h>

const int soilSensorPin = A0;    // Soil moisture sensor connected to analog pin
A0
const int ledPin = 13;           // LED connected to digital pin 13 const
int servoPin = 8;          // Servo motor connected to digital pin 9
const int trigPin = 10;          // Ultrasonic sensor trigger pin const int
echoPin = 11;          // Ultrasonic sensor echo pin

Servo myservo; // Create a servo object

void setup() {
  pinMode(ledPin, OUTPUT);
pinMode(servoPin, OUTPUT);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
  myservo.attach(servoPin); // Attach the servo to the specified pin
  Serial.begin(9600);
}

float getDistanceUltrasonic() {   digitalWrite(trigPin, LOW);
delayMicroseconds(2);   digitalWrite(trigPin, HIGH);
delayMicroseconds(10);   digitalWrite(trigPin, LOW);   float duration =
pulseIn(echoPin, HIGH);   float distance = duration * 0.0343 / 2;  //
Calculate distance in centimeters   return distance;
}

void loop() {
  int soilMoisture = analogRead(soilSensorPin); // Read analog value from soil
moisture sensor
  float ultrasonicDistance = getDistanceUltrasonic();  // Get distance from
```

ultrasonic sensor

```
  Serial.print("Soil Moisture: ");
  Serial.println(soilMoisture);
  Serial.print("Ultrasonic Distance: ");
Serial.println(ultrasonicDistance);

  int dryThreshold = 600;   int
dryThreshold1 = 700;  if
(ultrasonicDistance < 4) {
delay(1000);     if (soilMoisture >
dryThreshold) {
digitalWrite(ledPin, HIGH);
myservo.write(180);
     delay(1000);

    }
    if (soilMoisture < dryThreshold1)
{       digitalWrite(ledPin, HIGH);
myservo.write(0);       delay(1000);
   }   }    else {
digitalWrite(ledPin, HIGH);
myservo.write(90);
  }
}
```

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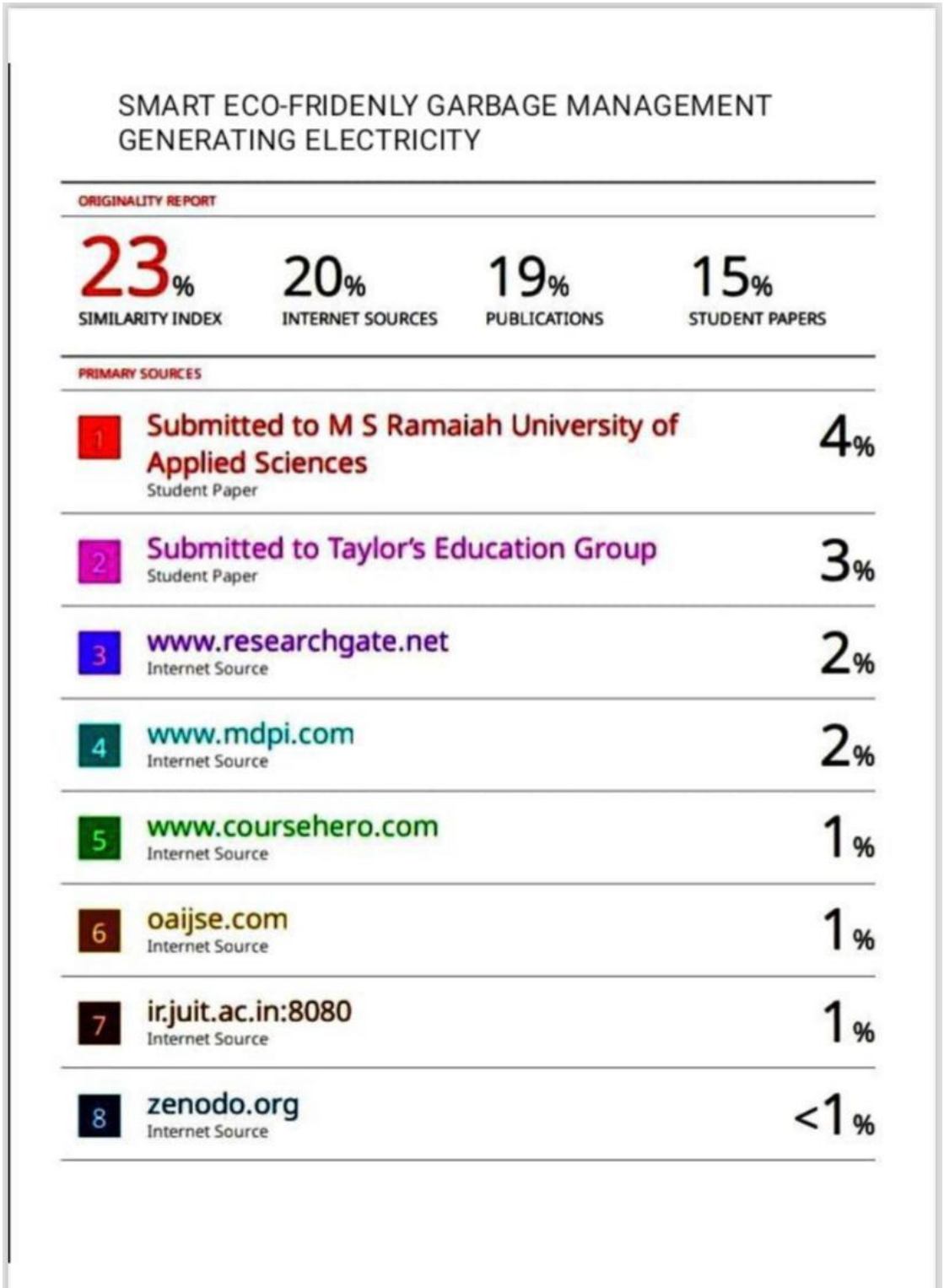

SMART ECO-FRIDENLY GARBAGE MANAGEMENT GENERATING ELECTRICITY

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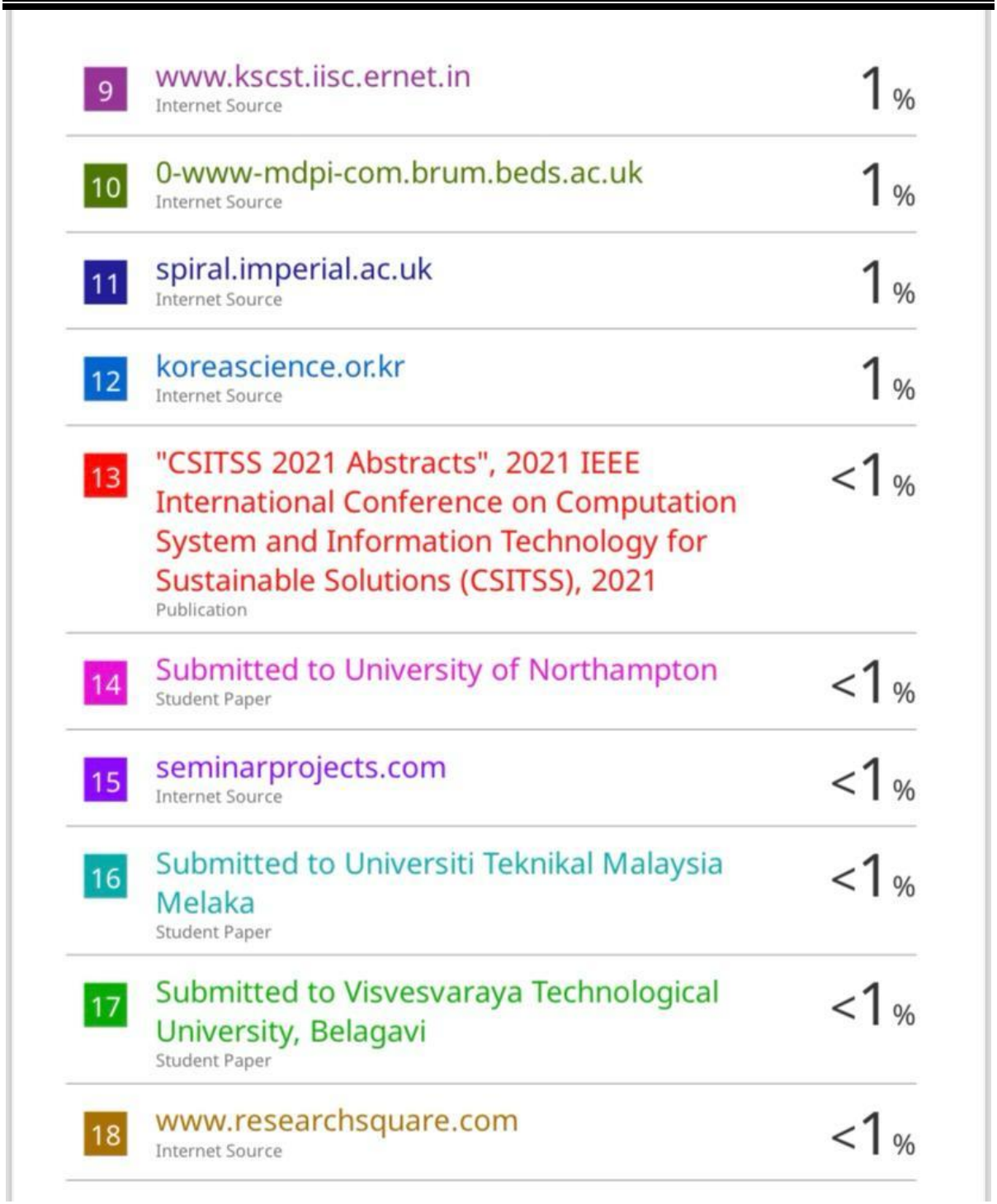

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The sustainable development goals (SDG) that includes of 17 goals to transform our world and to get a awareness in the people as per our project smart eco-friendly garbage management generating electricity in this project climate action and also sustainable cities and communities ,responsible consumption and production , affordable and clean energy ,good health and well -being sustainable development goals(SDG) are included through our project electricity generation with safe bio gas is from climate action and sustainable cities and communities by segregating dry and wet waste and also by collecting waste and generating electricity through it no waste will be on lands and communities ,affordable and clean energy from generating electricity of energy source good health because of reduction of huge garbage on lands by our project we can build a well-being sustainable development goals through it so these are the SDG goals that will included in our project.

A well-established energy system supports all sectors: from businesses, medicine and education to agriculture, infrastructure, communications and high technology.

Access to electricity in poorer countries has begun to accelerate, energy efficiency continues to improve, and renewable energy is making impressive gains. Nevertheless, more focused attention is needed to improve access to clean and safe cooking fuels and technologies for 2.3 billion people.

For many decades, fossil fuels such as coal, oil or gas have been major sources of electricity production, but burning carbon fuels produces large amounts of greenhouse gases which cause climate change and have harmful impacts on people's well-being and the environment. This affects everyone, not just a few. Moreover, global electricity use is rising rapidly. In a nutshell, without a stable electricity supply, countries will not be able to power their economies.

Without electricity, women and girls have to spend hours fetching water, clinics cannot store vaccines for children, many schoolchildren can not do homework at night, and people cannot run competitive businesses. Slow progress towards clean cooking solutions is of grave global concern, affecting both human health and the environment, and if we don't meet our goal by 2030, nearly a third of the world's population – mostly women and children – will continue tobe exposed to harmful household air pollution.

To ensure access to energy for all by 2030, we must accelerate electrification, increase investments in renewable energy, improve energy efficiency and develop enabling policies and regulatory frameworks.

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