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Recycling Plastic Waste Management with Using Automated Robot's

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Abstract: *India currently produces 188,000 tons of waste daily, with plastic waste making up approximately 9% to 12% of municipal solid waste, posing a toxic threat to the environment. The inability of plastic to biodegrade has created significant challenges for both urban and rural areas across the country. To tackle this growing problem, both public and private sector research initiatives have been launched. This study focuses on two popular methods that incorporate plastic waste in the construction of rural roads. It explores the implementation of these methods and the steps taken to enhance their effectiveness. Additionally, the study offers recommendations for other states to consider adopting these approaches for their own rural road development projects, using plastic waste as a sustainable material.*

Keywords: plastic waste, energy management, Recycling, robot, road, solar, raw materials, environment

I. INTRODUCTION

In this project, we introduce an energy management and automatic controlling system for the management of plastic waste. In India, there are large quantities of plastic being manufactured, and disposing of this plastic waste is a major challenge for public authorities. The use of this plastic waste is essential in the current situation in India. In line with this, the number of people and the roads are increasing day by day, so we must provide strong, solid roads to carry this growing highway traffic. There is a lot of research being done on the use of plastic waste to help increase the capacity of roads, repair potholes, and maintain these pits.

This is a new, innovative way of disposing of plastic waste. Plastic is a very flexible material, and due to the large production of plastic, it becomes necessary to find solutions. To overcome this scenario, we introduce a green energy system that is placed on a robot and operates through a mobile application. This machine is solar-based and also software-based. When we operate the machine, it uses electrical energy for its operation. As mentioned, the main problem statement of this study is that most of the plastic is utilized in road pothole repair. With the upcoming of machine-to-machine communication, where devices can be connected wirelessly through mobile applications, we have developed a solar-based machine for the management of plastic waste.

II. LITERATURE SURVEY

Fenty Puluhulawa et al. Plastic waste is the primary concern for many countries worldwide. In Indonesia, the issue remains a problem that requires greater attention. Although several regulations have been implemented to reduce plastic waste, efforts and strategies are essential to maximizing the outcomes of the laws. Plastic waste, if not disposed of properly, brings adverse effects on health. By that, the regional government is urged to come up with policies to reduce plastic waste. This paper discussed: First, the issues of plastic and people's needs for plastic in today's era. Second, it explored the policies of the regional government in developing a waste management program to combat the problem. The data of this empirical juridical research came from interviews and focus group discussions. [1]

Sun-Kyoung Shin et al. With an increasing use of plastic, considerable plastic waste is generated, threatening the environment and public health. In particular, changes in living patterns in urban areas have significantly impacted the rate at which plastic waste increases every year. Thus, governments in many developed countries have implemented numerous policies to reduce plastic waste generation. [2]

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Evgeniia Mykhailova et al. Methods of plastic waste management, the amou nt of which is constantly growing due to the high demand for polymer products with high-performance properties, are considered. The urgency of the problem is explained by the longevity of plastic, which, once in the environment, gradually degrades with the formation of substances dangerous to living organisms. Each of these methods has certain disadvantages, which necessitate the introduction of other measures. Recycling of plastic waste into secondary raw materials, energy, or products with certain consumer properties can be the promising method of plastic waste management from ecological and economic points of view. [3]

D.K. Mokashi et al. Garbage plastic and its disposal are a serious threat to the environment, causing global warming and pollution. The use of plastic waste in mixed bituminous strengthens the road and will be a solution for the dumping of plastic in the roadway, potholes, damage, and pathways. [4]

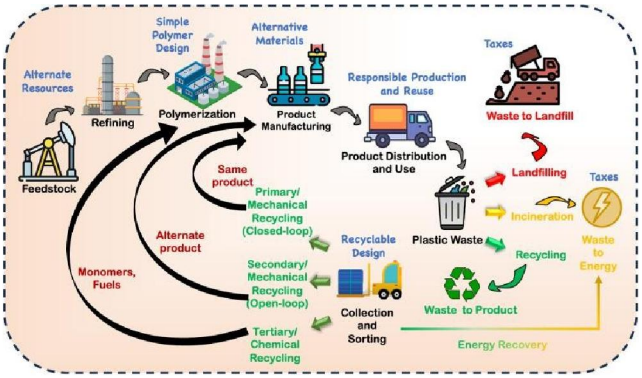

Fig 1. Plastic Waste Management

III. NEED OF THE PROJECT

Being used so commonly all over the world, the waste generated from the use of plastic is enormous. This waste, if not managed properly, has numerous ill-effects on the environment and living beings. Hence, plastic waste management is very important. It is concluded that the use of plastic wastes for construction applications will improve the sustainability of the environment significantly, and also serve as a reliable source of materials for construction purposes.

All over the world, there is a major issue of fuel shortage, so we have created a green energy source- based machine for the management of plastic waste. From these two problems, one being plastic waste and the second being the lack of fuel, we can solve both by creating a solution to repair potholes.

IV. EXISTING SYSTEM

In daily life, due to heavy traffic and the presence of water and oil on roads, potholes are created. At the same time, the government is unable to repair all the potholes on all roads because it requires many laborers and high costs. That's why we are moving forward with our project: a solar-based machine for the management of plastic waste to repair potholes.

V. HARDWARE REQUIREMENTS:

- Microcontroller (PIC18F4520)
- Temp sensor
- Ultrasonic sensor
- DC motors
- 16x2 LCD display
- Buzzer
- Relay

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- Bluetooth Module(hc05)
- L293D motor driver IC
- Hot Coil Mechanism

VI. SOFTWARE REQUIREMENTS:

- MPLAB IDE For Microcontroller Programming (embedded c)
- CCS Compile
- PIK Kit 3
- Proteus For Circuit Simulation
- Protel or PCB Wizard For PCB Design
- VB Software

Fig 2. Actual Project Model

VII. BLOCK DIAGRAM

- The project construction is design simple compare to other machine present in the market to repair pothole. The project construction is simple.
- The project consists of an aluminum container which is used to mix and heat the mixes.
- The container which is converted into a mixer by installing a DC gear motor of high torque with blade attach to the motor and an induction heater at the bottom of the container.
- We selected aluminum because heat transfer rate is high. The DC motor is given AC supply by connecting an adapter to the motor.
- The project cost is less compared to the other imported from abroad. The machine can be taken anywhere easily.
- To move container, we use Bluetooth module to send command wirelessly.

We designed a manually operated machine which will clean the pothole on the road, and will discharge the required amount of concrete to fill the pothole and to do a levelling process on the discharged concrete using the roller

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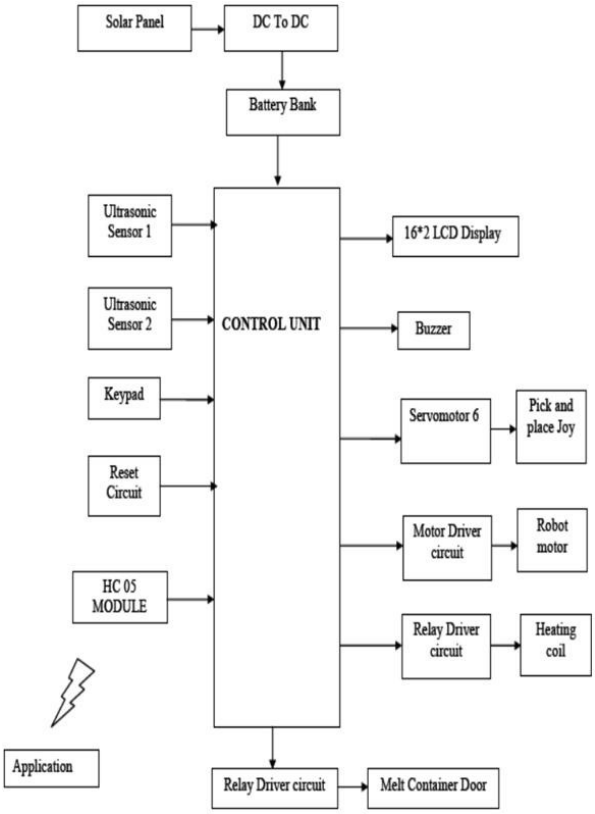

Fig 3. Block Diagram

IX . ADVANTAGES

- **Stronger road with increased Marshall Stability Value** – Indicates better road durability.
- **Better resistance to rainwater and water stagnation** – Roads are more water-resistant, reducing damage from water.
- **No stripping and no potholes** – Fewer road surface issues such as stripping and potholes.
- **Increased binding and better bonding of the mix** – More effective bonding between materials for a stable surface.
- **Reduction in pores in aggregate, hence less rutting and raveling** – Improved road surface integrity and longevity.

X . LIMITATIONS

- **Cleaning process**: Toxic substances from mixed plastic waste may leach during recycling, posing environmental risks.
- **During road laying process**: Chlorine presence can release harmful HCL gases, which could be hazardous.
- **Post-laying issues**: Initial rainfall can trigger leaching, and plastic may form a sticky layer that causes mechanical abrasion.
- **Components are not inert after road laying**: The materials in the road could react with the environment, affecting long-term stability.

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XI. FUTURE SCOPE

- **Solution for plastic recycling**: Promoting greater use of recycled plastics can help solve plastic pollution and landfill issues.
- **Improved roads in cities**: Better road quality will lead to smoother travel and transportation.
- **Reduction in pothole-related accidents**: Less frequent potholes can minimize road accidents.

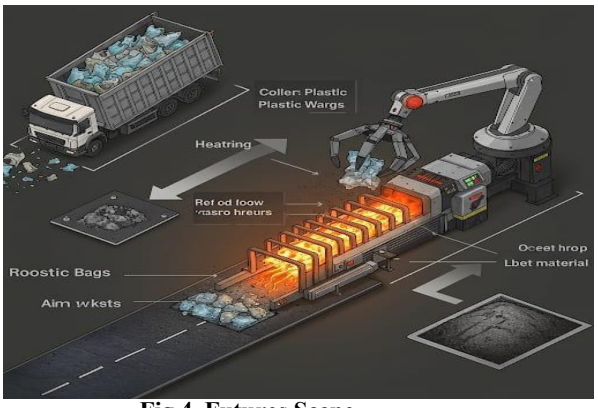

Fig 4. Futures Scope

The diagram depicts a system for automated processing of materials, likely with a focus on recycling or manufacturing.

Key Trends:

Increased Automation:

Robots are becoming more sophisticated and capable of performing complex tasks with minimal human intervention.

Artificial Intelligence (AI):

AI is being integrated into robotics to improve decision-making, object recognition, and navigation.

Sustainability:

There's a growing focus on developing sustainable technologies that reduce environmental impact.

Internet of Things (IoT):

Robots are being connected to the IoT to enable remote monitoring and control.

In conclusion, this diagram represents a versatile system with wide-ranging applications. As technology advances, we can expect to see even more innovative and impactful uses for such systems

XII. CONCLUSION

- **Improved road quality**: Using plastic waste from various industries can contribute to better road construction techniques.
- **Efficient waste management**: The process aids in disposing of 80% of waste polymers in an easy-to-use form.
- **Cost reduction**: The use of composite plastics can reduce road repair costs by minimizing potholes.
- **Environmental benefits**: This approach not only improves road durability but also contributes to reducing plastic waste and pollution.
- **Reduced need for compaction**: This technique decreases compaction needs by up to 20%, improving efficiency and avoiding waste disposal through heating.

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