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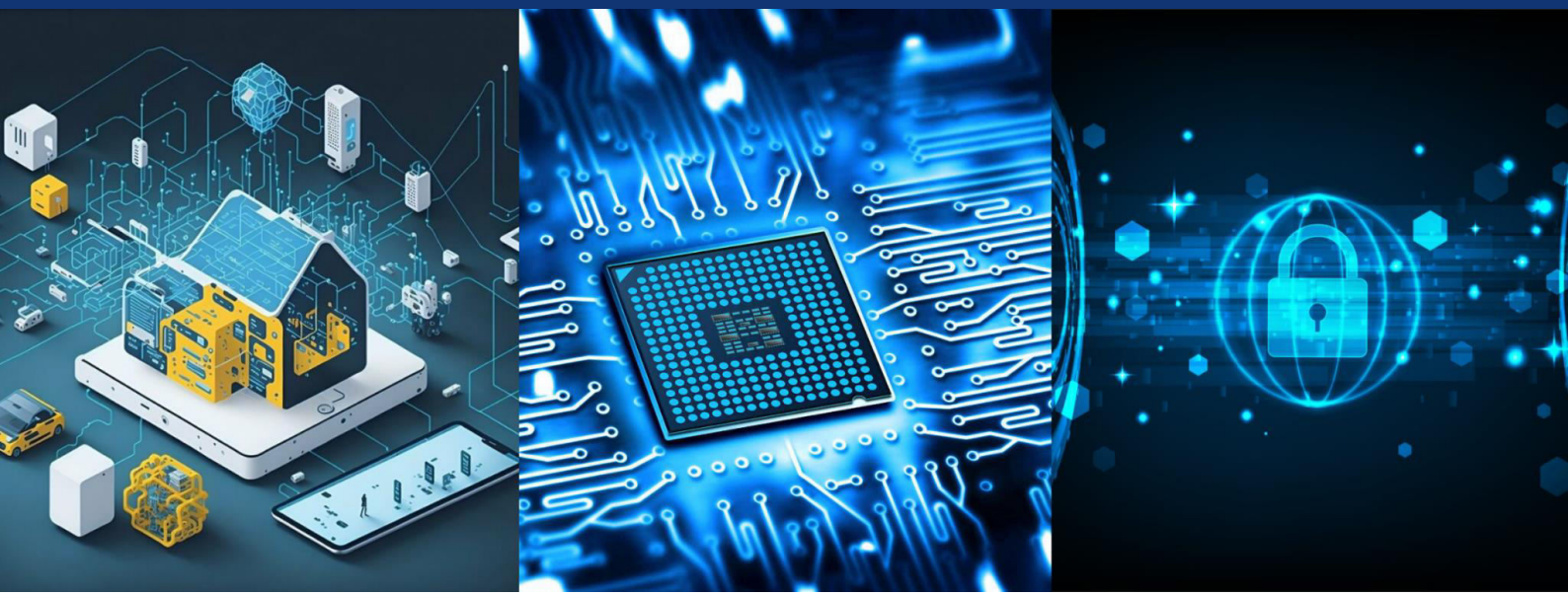

International Journal of Innovative Research in Computer and Communication Engineering

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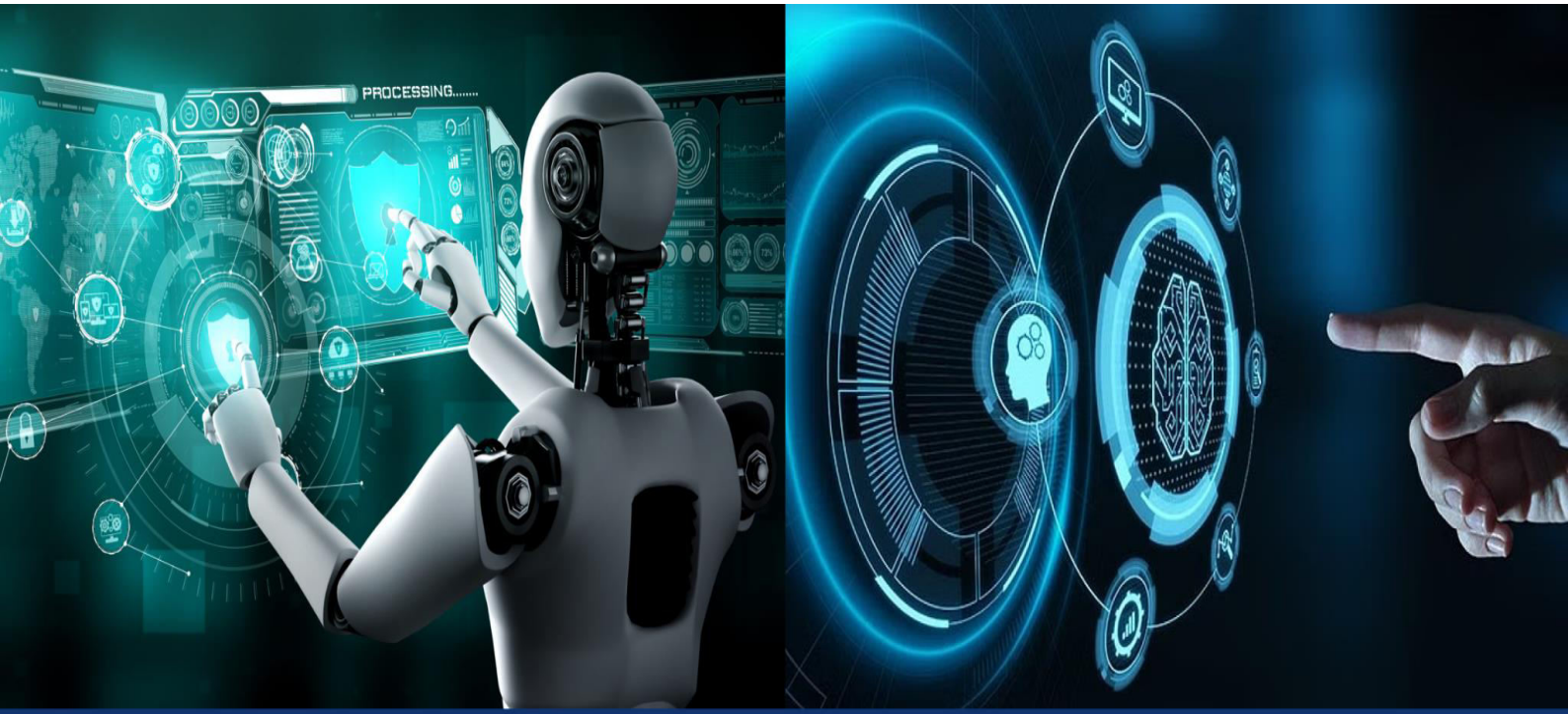

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IOT based Garbage Management System

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ABSTRACT: The IoT-Based Garbage Management System is an innovative solution designed to enhance urban waste management by automating the monitoring of waste levels in public bins. Using the ESP32 microcontroller for connectivity, the system tracks waste levels in two designated bins for dry and wet waste, utilizing ultrasonic sensors to measure fill levels accurately.

Real-time data is displayed on a 20x4 graphical LCD, allowing easy monitoring. When waste reaches a set threshold, an automated alert is sent to waste management personnel via SMS or email, prompting timely collection to avoid overflow. This system improves resource allocation, reduces unsightly litter, and integrates seamlessly with other smart city technologies, contributing to cleaner and more sustainable urban environments.

I. INTRODUCTION

In rapidly urbanizing areas, the challenges of waste management are becoming increasingly complex. With the surge in population and industrial activity, traditional methods of waste collection struggle to keep up with the growing volume of waste. This often results in overflowing bins, scattered litter, and significant health hazards, which in turn affect the quality of life and environmental health of urban areas. As a result, there is an urgent need for smarter, more efficient solutions to manage waste collection and disposal.

The IoT-Based Garbage Management System addresses this need by integrating modern technology into the waste management process. Leveraging the capabilities of the ESP32 microcontroller and ultrasonic sensors, this system is designed to monitor waste levels in real time. Sensors installed in bins designated for dry and wet waste continuously measure fill levels, and when bins reach near-full capacity, notifications are automatically sent to waste management teams via SMS or email. This system enables real-time monitoring and allows for optimized collection routes, ensuring that bins are only serviced when necessary.

By reducing the need for constant manual checks and preventing bin overflow, this IoT-based approach not only improves operational efficiency but also fosters cleaner and healthier urban environments. As a scalable and proactive solution, the IoT-Based Garbage Management System represents a significant step towards sustainable and smart urban waste management. Waste generation in urban areas of India will be 0.7 kg per person per day in 2025, approximately four to six times higher than in 1999. According to the Ministry of Environment, Forest and Climate Change, India currently generates 62 million tons of waste (both recyclable and non–recyclable) every year, with an average annual growth rate of 4%. Solid waste, plastic waste and E-waste are the principal waste materials.

II. LITERATURE SURVEY

Overflowing Garbage Bins Issue:

- Public bins often overflow, causing unhygienic conditions and health hazards due to bacteria and virus growth.
- IoT-based systems alert authorities to prevent overflow and segregate waste for appropriate processing methods like composting and recycling.

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- **IoT-Based Waste Management**:
  - Utilizes ESP32 microcontrollers, ultrasonic sensors, and GSM/GPRS for real-time bin monitoring.
  - Sends notifications via SMS or email when bins are near full, optimizing garbage collection routes.

- **Smart Bin Features**:
  - Integrates cloud computing for data analysis and predictive route generation for garbage trucks.
  - Web interfaces and LCD displays show bin fill levels, ensuring timely action by authorities.

- **Environmental Benefits**:
  - Helps maintain cleanliness, reduces manual checks, and supports initiatives like Swachh Bharat.
  - Monitors temperature, humidity, and hazardous gas levels, aiding in fire prevention and health safety.

- **Automation and Efficiency**:
  - Automated alerts for full bins ensure efficient waste management.
  - Records maintained for each bin's status to ensure timely cleaning, reducing environmental issues caused by delayed garbage collection.

- **Advanced Technology Usage**:
  - Incorporates IoT, cloud computing, and embedded systems to enhance garbage management.
  - Reduces the frequency of garbage truck trips and supports sustainable urban waste management practices.

- **Health and Environmental Impact**:
  - Prevents overflow-related diseases and minimizes harm to stray animals from consuming hazardous waste.
  - Supports green environments through smart, real-time waste monitoring systems.

III. SYSTEM DESIGN

1. Power Supply: Provides power to the entire system, ensuring all components operate effectively.
2. **ESP32 Microcontroller:** Serves as the main control unit, processing data from sensors and modules to monitor and manage the garbage levels in both dry and wet waste bins.
3. **Ultrasonic Sensor 1 (Dry Waste Dustbin):** Measures the level of garbage in the dry waste bin by sending distance data to the ESP32. If the bin is nearly full, the system can take necessary actions.
4. **Ultrasonic Sensor 2 (Wet Waste Dustbin):** Like the first sensor, this sensor monitors the level of garbage in the wet waste bin.
5. **Global Positioning System (GPS) Module:** Tracks the location of the dustbin. If the bin is full, the system sends its location to the garbage collection vehicle for optimized collection.
6. **Liquid Crystal Display (LCD) 20x4:** Displays the garbage levels and other relevant information to allow users and maintenance staff to view the bin status directly.
7. **SIM800C GSM / GPRS Module:** Communicates with the garbage collection system by sending alerts when bins are full. It uses the GSM/GPRS network to send messages, including the GPS location if necessary.
8. **PIR Sensor:** Detects human presence around the bins. This can be used for enhanced functionality, such as activating the display only when someone is nearby to conserve power.

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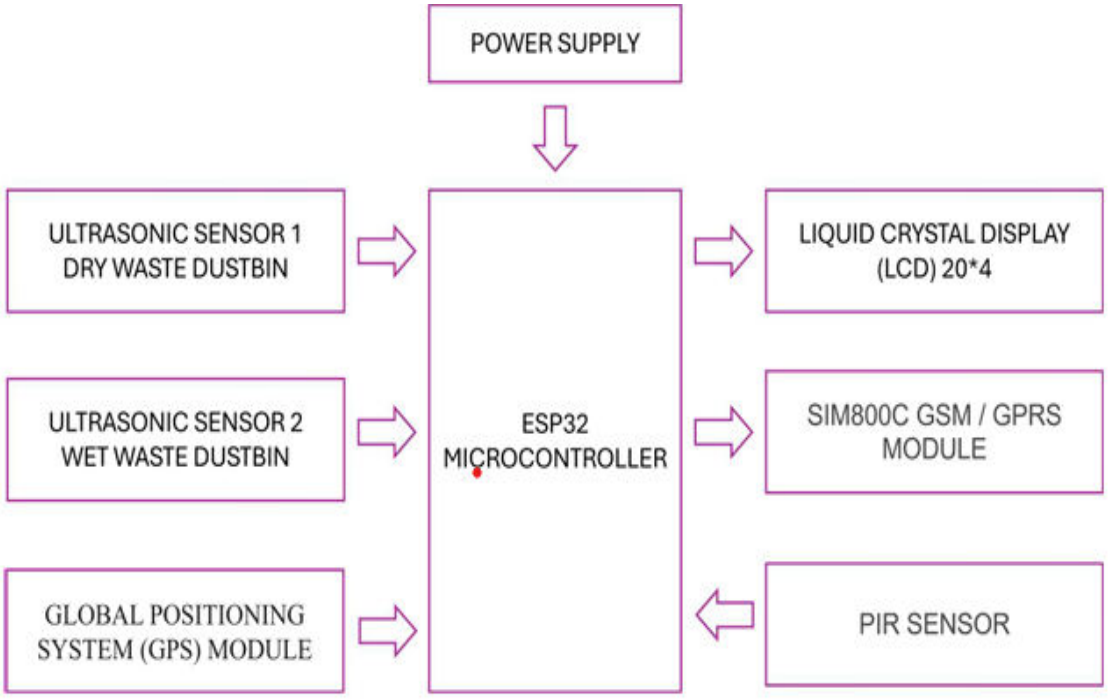
IV. SYSTEM ARCHITECTURE



V. FUTURE SCOPE

1. Integration with IoT and AI: By incorporating AI and IoT, the system can analyze waste patterns, predict peak waste times, and suggest optimal collection schedules for further efficiency.
2. Waste Sorting and Segregation: Future iterations could include automated waste sorting mechanisms that separate recyclables from non-recyclables at the source, enhancing recycling efforts and reducing landfill waste.
3. Solar Power Utilization: Adding solar panels to power the system would make it energy-independent, especially useful for remote or outdoor applications, reducing reliance on external power sources.
4. Mobile App Integration: A mobile app could allow city authorities and users to track bin statuses, view garbage levels in real-time, and receive alerts and notifications directly on their devices.

VI. CONCLUSION

The IoT-based Garbage Management System offers a smart, efficient, and scalable solution to the growing waste management challenges in urban areas. By leveraging real-time monitoring, automated alerts, and optimized collection routes, this system minimizes overflow, reduces manual intervention, and promotes cleaner, healthier environments. It enhances operational efficiency, supports waste segregation for proper disposal methods, and contributes to sustainable urban living. Ultimately, this technology not only improves waste management practices but also aligns with initiatives for smarter and greener cities.

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REFERENCES

[1] Gopal Kirshna Shyam, Sunilkumar S. Manvi, Priyanka Bharti, "Smart Waste Management using Internet-of-Things(IoT)", 2017 Second International Conference On Computing and Communications Technologies(ICCCT'17).
[2] Sagnik Kanta, Srinjoy Jash, Himadri Nath Saha, "Internet Of Things Based Garbage Monitoring System", Industrial Automation and Electromechanical Engineering Conference,16- 18 August 2017, Bankok , Thailand.
[3] S. Vinoth Kumar, T. Senthil Kumaran, A. Krishna Kumar and Mahantesh Mathapati, "Smart Garbage Monitoring and Clearance System using Internet of Things", 2017 IEEE International Conference on Smart Technologies and Managementfor Computing, Communication, Controls, Energy and Materials (ICSTM), Veltech Dr.RR & Dr.SR University, Chennai, T.N., India. 2 – 4 August 2017. pp.184-189.
[4] Abrar Alkhamisi , Mohamed Saleem Haja Nazmudeen, Seyed M. Buhari, "A Cross-Layer Framework for Sensor Data Aggregation for IoT Applications in Smart Cities", Smart Cities Conference (ISC2), 2016 IEEE International.
[5] Jetendra Joshi, Joshitha Reddy, Praneeth Reddy, Akshay Agarwal, Rahul Agarwal, Amrit Bagga, and Abhinandan Bhargava, "Cloud Computing Based Smart Garbage Monitoring System", 2016 3rd International Conference on Electronic Design (ICED), August 11-12, 2016, Phuket, Thailand.

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