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Smart City

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ABSTRACT: This paper presents an idea or a concept for a smart city. The smart city represents the next evolution in urban development, where digital technologies, data-driven solutions, and interconnected systems transform the way cities operate and how residents interact with their environment. Smart cities aim to enhance sustainability, mobility, and quality of life. The smart city concept integrates advanced technology and the Internet of Things (IoT) to improve urban living. Key components of this vision include smart street light, which utilizes sensors and data analytics to optimize energy usage by adjusting brightness based on traffic and pedestrian presence. It helps to reduce carbon footprint using efficient LED bulbs. Smart dustbins are equipped with sensors to monitor waste levels, enabling efficient collection modules and reducing environmental impacts such as pollution. It also gives alert messages when dustbins are filled and sends them to the respective office so they can send a cleaning vehicle to pick up the garbage. Smart car parking systems leverage real-time data to guide drivers to available parking spots, reducing congestion and emissions, and preventing accidents such as dashing cars. Smart zebra crossings are designed with embedded sensors that detect approaching pedestrians and communicate with traffic signals to ensure safer and more efficient crosswalks. Innovations like smart street lights, smart dustbins, smart car parking, and smart zebra crossing provide cities with real-time data, helping to reduce costs. The modules are developed using IR sensors and ultrasonic sensors for movement detection. Arduino Uno is used to design circuits.

These innovations create a seamless, sustainable, and safer urban environment, improving the quality of life for citizens. It makes citizens' lives more efficient and easier. Most important it saves time.

KEYWORDS: Smart city, Internet of Things (IoT), urban development, digital technologies, sustainability.

I. INTRODUCTION

A. Overview:

Future cities can be more efficient as they work automatically based on sensing. This reduces human efforts and also saves time. A smart city is a futuristic approach to alleviate obstacles triggered by increasing population and fast urbanization which is going to benefit the government. Present street lights, dustbin management, and car parking management are done manually, to reduce this human effort smart city provides the modern touch of automation. It saves electricity and stops the wastage. Also, prevents the soil pollution which was produced due to litter. It saves the time of drivers for parking cars and prevents accidents in parking zones like dashing cars. It is helpful for pedestrians to cross the road safely and alerts the driver.

B. Proposed system functions:

This is an IOT-based project. It makes the use of Arduino Uno to design the circuit. It also uses ultrasonic sensors and IR sensors to detect the movement so they can work as they are designed to do. Also, servo motors are used for lifting the dustbin lid, and parking gate, and LCD is used to display the availability of slots of parking. GSM module allows tracking, navigation, and sending alert messages. Also, the GPS module will provide the location of the dustbin which gets filled.

- IR sensors
- Ultrasonic sensors
- Arduino Uno
- Servo motor

- LCD
- GPS module
- GSM module
- ESP8266
- LDR module

C. Advantage of Smart city

In recent years, all the work was done manually which is time-consuming and requires a lot of manpower. But with the new technologies and using internet upgradation is made. Environmental benefits lower energy consumption translates to a lower carbon footprint and contributes to a more sustainable environment.

1. **Dynamic:** Dynamic lighting controls based on movement detection.
2. **Reduced Cost:** Reduced energy cost and usage with flexible dimming controls.
3. **Pollution Free:** Reduced carbon emissions and light pollution.
4. **Resource Optimization:** The traditional methods of waste collection often lead to unnecessary trips when bins are not full, wasting both time and fuel. With smart dustbins, collection services are alerted when the bin is nearing capacity, thereby streamlining collections and saving resources.
5. **Security:** Less Possibility of Accidents in parking slots.
6. **Any-Time Access:** Pedestrians can cross safely at any time, as the system improves visibility and alerts drivers continuously.
7. **Improved Safety:** Makes crossings more visible, reducing the risk of accidents.

II. SYSTEM ANALYSIS

A. Problem Definition:

Smart cities face various challenges during their development. It requires sustainability, financial support, and difficulty in achieving security. To overcome this problem the main objective of this research is to design and implement a smart city using IoT that is capable of controlling and based on automation. The problem definition in a smart city could be related to the challenges and issues faced during the development or implementation of new technology that the system is trying to solve or address. Some of the potential problem definitions that a smart city may be designed to address could include:

- **Energy efficiency:** Traditional street lights are energy efficient and can remain on unnecessarily, consuming power even when there is no need for lighting. This also causes higher operation and maintenance costs. Smart street lights with sensors can automatically adjust their brightness based on pedestrian or vehicle presence optimizing energy usage and reducing cost.
- **Urban sustainability:** Overflows, inefficient waste collection schedules, and inadequate monitoring of waste levels can lead to unsightly garbage in public spaces, affecting city cleanliness and hygiene. Smart dustbins are occupied with sensors that monitor fill levels and alert waste collection services when bins are full. Reducing unnecessary trips and improving cleanliness.
- **Operational optimization:** Increasing urbanization has led to parking congestion, with drivers wasting time and fuel searching for available parking spots. This exacerbates traffic jams and air pollution. Smart car parking that includes real-time parking space availability tracking, optimizes parking space utilization and improves the overall urban mobility experience.
- **Security:** Inadequate visibility and awareness of pedestrian crossings, especially during night time or bad weather, lead to increased accidents, slowing down pedestrian movement and traffic. Smart zebra crossing can feature illuminated, sensor-based technology that activates in real time as a pedestrian approach. This enhances visibility, ensuring safer crossings and smoother traffic flow

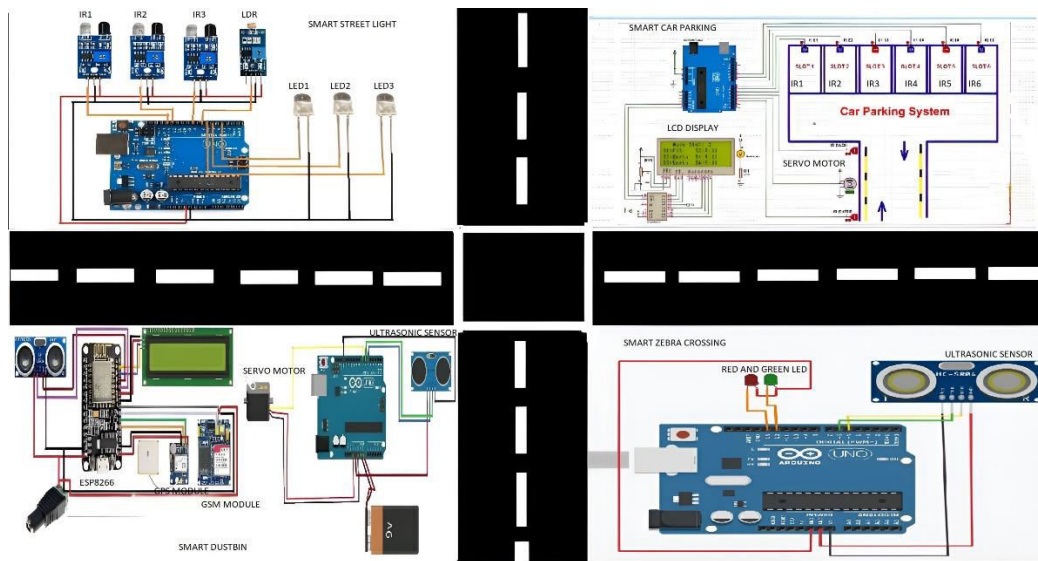
The problem definition will depend on the specific needs and requirements of the smart city and its occupants, and the smart city will be designed to address these needs in the most effective way possible.

B. Implementation:

In this smart city project, we used Arduino Uno to design the circuits. In the smart street light, we have connected IR sensors, an LDR module, and LEDs to the Arduino so based on movement detection it will glow during night time, and in the daytime, it will remain off as lights fall on the LDR module. In the smart dustbin ultrasonic sensor and servo motor are connected to Arduino Uno so it can detect the garbage and open the lid of the dustbin. The GSM module sends the alert message of the dustbin filled to the respective office and the GPS module sends the location of the

dustbin which is filled. ESP8266 provides Wi-Fi. In smart car parking servo motor, IR sensors, and LCD are connected to Arduino Uno, servo motor is used to open the entry and exit gates. IR sensors are used to detect whether slots are occupied or vacant. As per that LCD will display the message. In smart zebra crossing ultrasonic sensors and LEDs are connected to the Arduino Uno. As the ultrasonic sensor detects the pedestrian crossing it will glow a red LED and once the pedestrian crosses the road it will glow green.

C. Circuit of the Smart city Project using Arduino:



- In smart street light IR1,IR2,IR3 are connected 12,13,8 connector of Arduino uno, LDR is connected to the 7 connector. LEDs are connected to the ~3,~5,~6 and one point(black cable) connects to ground. Red cable connects to +5v.
- In smart dustbin ultrasonic sensor is connected to the ~5,~6. Servo motor is connected to 7 connector and +5v and ground connector. GSM module and GPS module is connected to the ESP8266.
- In smart car parking IR1,IR2,IR3,IR4,IR5,IR6 is connected to the ~3,~5,~6,~9,~10,~11. LCD display is connected to ground and +5v. SDA and SDL is connected to A0,A5.
- In smart zebra crossing Ultrasonic sensor is connected to the ground and +5v. Trlq and echo is connected to the ~6,~5. Red and green led short terminal is connected to ground and other terminal is connected to the 13,12.

III. DISCUSSION

A. Interpretation of results:

Based on the project description, it can be inferred that the implementation of a smart city project using Arduino Uno is successful. IR and ultrasonic sensors can detect the movement of vehicles and pedestrians on the road. LEDs are used in smart street lights which are turned on with full intensity when the IR sensor detects the vehicle or pedestrian and when there is no pedestrian or vehicle on the road it will glow with ¼ intensity but only during night time. At day time it will be turned off. Day or night time can be detected using the LDR module. As well as IR sensors are used in parking slots, whether slots are vacant or occupied. The Servo motor is used to open the lid of the dustbin as well as it is used to open and close the parking gate. ESP8266 provides Wi-Fi. The GSM module is used to send an alert message to the respective office when the dustbin is filled. GPS sends the location of the dustbin which gets filled. LCD is used to display how many slots are vacant and occupied in smart car parking. In this way, all four modules are connected to Arduino Uno and once the code is loaded in Arduino Uno, we don't require internet connectivity. And smart city is successfully implemented.

B. Comparison with previous research:

In previous smart street light module lights were turned on or off. But as we know during night time we cannot keep total darkness on the road when there is no vehicle or pedestrian passing, we require some amount of light, so when there is no

vehicle or pedestrian on the road it will glow with $\frac{1}{4}$ intensity. Which is energy efficient. In previous smart dustbin modules, there was implementation of either alert messages or locations of dustbins. But here we combined both modules so they can work parallel. In previous car parking, there was no LCD, so the driver didn't know if parking slots were vacant or occupied, but using the LCD we can inform the drivers about slots. It also helps to reduce the kind of manpower based on automation. In the previous zebra crossing, we needed was timer on that basis LED would glow green again. But in this module, there is no timer. The sensor will detect whether pedestrians cross the road depending on the range. Once the pedestrian crosses the road red LED will be turned green. And the vehicle can start moving.

C. Limitations of the study:

When there are failures, it requires specialized knowledge and skills to troubleshoot. Any components that fail (e.g., the connectivity or sensors) can disrupt the process. It will be not able to move automatically. Automated systems require a stable power supply to operate effectively. Power outages or electrical failures can disrupt operations and affect user experience.

D. Suggestions for future research:

Further research could investigate, whether smart street lights can be equipped with cameras and other sensors to collect data on traffic flow, air quality, noise levels, and other environmental factors. By integrating with traffic management systems, smart street lights can help manage traffic flow and reduce congestion in real time. Smart street lights can be powered by renewable energy sources such as solar or wind power, reducing the carbon footprint of street lighting systems. In smart dustbins, we can include an odor control mechanism to get rid of the foul smell of organic garbage. To enhance it further, an automated system can be developed that can pick up waste in and around the bin, segregate it, and put it in bins. In smart car parking, we can include a slot allocation method so we can book our own cheapest parking slot. It is an efficient one for solving parking problems, which overcomes traffic congestion and also provides an automated billing process. Safety measures such as tracing the vehicle number, face recognition of the drivers to avoid theft & automatic billing process can also be designed, also we can implement a CCTV camera for security purposes. In smart zebra crossing, we can Integrate advanced sensors and adaptive lighting to further improve visibility and response times, making crossings even safer for pedestrians. Develop systems that communicate with other traffic signals and smart city infrastructure to optimize traffic flow and enhance overall road safety.

IV. CONCLUSIONS AND FUTURE WORK

A. Conclusion:

The IoT-based smart city has been successfully implemented and tested. In conclusion, the integration of smart technologies like smart street lights, smart dustbins, smart car parking, and smart zebra crossings plays a pivotal role in transforming urban environments into efficient, sustainable, and user-friendly spaces. Smart street lights enhance energy efficiency and safety, while smart dustbins contribute to cleaner cities by optimizing waste management. The implementation of smart car parking systems reduces traffic congestion and improves urban mobility, and smart zebra crossings ensure pedestrian safety with real-time adjustments. Collectively, these innovations create a more connected, sustainable, and livable city, improving the quality of life for residents and making cities smarter and more resilient for the future.

B. Future work:

The future of the smart city will include technology-driven smart city solutions. The smart sensors can transmit data showing any structural changes. Cities will be able to plan better with their ability to analyze relevant data on infrastructure, enabling proactive maintenance and better planning for future demand. Smart cities are moving towards this shift by using smart technologies that help create a better everyday life for citizens. Our smart technologies help the city head with smart city planning, leveraging technologies that promote sustainability, public safety, energy efficiency, and overall improved quality of life.

Certainly, here are some potential future works for this IoT-based smart city:

- **Advanced monitoring:** Smart Street lights can be equipped with cameras and other sensors to collect data on traffic flow, air quality, noise levels, and other environmental factors.
- **Increased safety:** Smart Street lights can be programmed to automatically adjust lighting levels based on real-time data, making streets safer and reducing the risk of accidents.
- **Waste management:** The odor control mechanism to get rid of the foul smell of organic garbage. An automated

system can be developed that can pick up waste in and around the bin, segregate them, and put them in bins.

- **Safety:** Safety measures such as tracing the vehicle number, face recognition of the drivers so as to avoid theft & automatic billing process can also be designed.
- **Enhanced Safety:** Integrate advanced sensors and adaptive lighting to further improve visibility and response times, making crossings even safer for pedestrians.
- **Smart Traffic Management:** Develop systems that communicate with other traffic signals and smart city infrastructure to optimize traffic flow and enhance overall road safety.

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REFERENCES

1. Mohd. Saifuzanman, and Nazmun Nessa Moon, Femaz Narin Nur. "IoT Based Street Lighting and Traffic Management System". IEEE Region 10 Humanitarian Technology Conference (R10-HTC), 2017
2. P. P. F. Dheena, G. S. Raj, G. Dutt and S. V. Jinny, "IOT based smart street light management system" 2017 IEEE International Conference on Circuits and Systems (ICCS), Thiruvananthapuram, India, 2017, pp. 368-371, doi: 10.1109/ICCS1.2017.8326023
3. O. Rudrawar, S. Daga, J. R. Chadha and P. S. Kulkarni, "Smart Street lighting system with light intensity control using power electronics," 2018 Technologies for Smart-City Energy Security and Power (ICSESP), Bhubaneswar, India, 2018, pp. 1-5, doi: 10.1109/ICSESP.2018.8376692.
4. Vikrant Bhor, PankajMorajkar,DishantPandya."Smart Garbage Management System" International Journal of Engineering Research & Technology Vol. 4 Issue 03, March-2015.
5. Rahman, H., Al-Muyeed, A. (2010). "Solid and Hazardous Waste Management", ITN-BUET, Centre for Water Supply and Waste Management.
6. M Sodiq ,HHasbullah "Prototype of Arduino Based Parking Rotation System" , ISMEE ,2017
7. Maher Hassan Kadhim, "Arduino Smart Parking Manage System based on Ultrasonic Internet of Things (IoT) Technologies" ,IJET ,2018
8. SuvarnaNandyal, PhD ,Sabiya Sultana, SadafAnjum . "Smart Car Parking System using Arduino UNO", International Journal of Computer Applications (0975 – 8887) , Volume 169 – No.1, pp. 14-18, July 2017.
9. Journal homepage: www.ijrpr.com ISSN 2582-7421 Arduino Based Smart Car Parking Yogeshkumar Chaurasia1 , Sumitkumar Chaurasiya2 , Prof Sachin M Vaidya3
10. International Journal of Technical Research and Applications e-ISSN: 2320-8163, www.ijtra.com Special Issue 40 (KCCEMSR) (March 2016), PP. 104-108 104 | P a g e MANAGEMENT OF CAR PARKING SYSTEM USING WIRELESS SENSOR NETWORKS.
11. Design and Implementation of Smart Zebra Crossing using Arduino Aditi Mane, Chetana Bachhav,Kiran Alandkar, Akanksha Agre, Adarsh Chikate, Shubham Andhale, Aditya Warange ,Aayushi Kumari, Mrs. S.G. Madhikar
12. Bobins Abraham, updated on 25 January 2023, "India times", accessed on 16 August 2023, <<https://www.indiatimes.com/news/india/one-third-road-accident-deaths-in-india-are-pedestrians-how-did-they-become-death-traps-591086.html>>



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