e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:06/June-2022 Impact Factor- 6.752 www.irjmets.com

IoT BASED SMART CITY

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ABSTRACT

Cities need intelligence to become smart cities. There is a need for the measurements of aspects such as city structure and governance, communication, mobility and traffic, transport and logistics, energy and resource infrastructure, water, health, environment and climate, safety and education. A smart city will promote a healthy and decent quality of life for its citizens while it promotes better infrastructure, clean and sustainable environment using smart solutions. IoT is important for every city because population is growing numerously. Large population demands larger resources with the clever use of smart city and widespread of IoT technology. Connected technologies and Big Data can create smart solutions. The solutions can solve problems, increase the quality of life for city residents and lower the consumption of resources. The main goal of smart city is to optimize city functions and promote economic growth.

The various applications of smart city are:

1) Smart Parking System
2) Automatic Street light system
3) Air pollution monitoring

Keywords: Intelligence, smart city, Infrastructure, IoT, Quality life.

I. INTRODUCTION

Smart cities have utilized technology to make their living conditions more efficient and made effective use of resources. Smart cities have the necessary ingredients for a projected fast growth rate in urban populations over the next few decades. Smart city requires a variety of innovative services that provide information to all citizens about all aspects of city life via interactive and internet-based applications. Smart city is a city where smart services are accessible regardless of time or place that is provided by city manager to improve citizens' quality of life. A smart city which uses digital technologies or information and communication technology to enhance quality and performance of urban services, sectors that have been developing the smart city technologies including government services, transport and traffic management , energy, health care, water and waste. The diversity of Smart services innovation and the rapid development of smart city across globe had led to gap between theories and practices. Each city in different countries has a diversity and focus on different services.

INTRODUCTION TO SMART PARKING SYSTEM

Smart parking system is an integrated system to organize cars in parking slots. The motivation of this project is to help drivers. Smart parking system using IoT is to identify vacant positions and occupied position without the need to waste time in finding suitable position for cars. The recent growth in economy and due to the availability of low price cars in the market, an every average middle-class individual can afford a car, which is good thing, however the consequences of heavy traffic jams, pollution, less availability of roads and spot to drive the motor car. One of the important concerns, which are to be taken in accounting, is the problem of parking those vehicles .Though, if there is space for parking the vehicle but so much time is squandered in finding that exact parking slot resulting in more fuel intake and not also environment friendly.

Initially when the user is about to enter the location the sensor detects and displays the number of empty and filled spots and when the user is with its vehicle near to the parking detect sensor ,he/she would be thrown with a notification on their mobile app of the parking slot number ,where they should park there vehicle.

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INTRODUCTION TO AUTOMATIC STREET LIGHT SYSTEM

The idea of designing a new system for the street light is that it does not consume huge amount of electricity and illuminate large areas with the highest intensity of light . Providing street lighting is one of the most important and expensive responsibilities of a city. Lighting can account for 10–38% of the total energy bill in typical cities worldwide. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources every year, and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically.

Automatic street light control system is used to control the street lights turn ON and OFF based on the LDR sensor. It automatically switches ON lights when the sunlight goes below the visible region of our eyes.It automatically switches OFF lights when the sunlight falls on it.

INTRODUCTION TO AIR POLLUTION MONITORING SYSTEM

Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma. According to a survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone. Whereas in EU number reaches to 300,000 and over 3,000,000 worldwide. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all.

IOT Based Air Pollution Monitoring System monitors the Air quality over a web server using Internet IoT based Air pollution monitoring system is used to monitor the air quality over a web server using internet. It will send a message when it detects any harmful gases in the air like c02, smoke, alcohol, benzene etc.

II. LITERATURE REVIEW

During the literary review it was detected that there are diverse cases of investigation that approach the topic smart city, from the perspective of the author different definitions have been generated from the characteristics that integrate the case study, of there is no exact definition of the construct and with recurrence it tends to show itself as a starting point to be a progressive and inclusive city, besides being an indicator of development in urban areas for the European Union (Hollands, 2008).

SMART CITIES

There are different definitions of what a Smart city is, so variations are present when replacing the term intelligent in a similar way with digital or intelligent. This leads to an inconsistent application, so that there is no single definition or defined scheme. In the 1990s, the California Institute for Intelligent Communities began work to determine the possibility that communities could be intelligent and cities could be planned based on the application of ICTS (O'Grady and O'Hare, 2012; Albino et. al., 2015), and the concept of intelligent city emerged from previous work.

FIX MY STREET BUILT BY MY SOCIETY – UNITED KINGDOM

The particular open sourced web service initiated by My Society has become a role model for several other countries as a crowdsourcing platform that collects information regarding potholes, dangerous pavements, broken street lights etc. The service lets the people to view, report or discuss their problems related to streets to the respective local council. This service in a particular creates a satisfactory relationship between the citizens and the governance that contributes considerably to the smart city planning. Similar systems include City Sourced in United States of America, FixEmUp in Tornio and other systems in countries like Australia, Chile, Switzerland, Japan, Malaysia etc.

NETWORK - ENABLED LED STREET LIGHTING SYSTEM – AMSTERDAM

The energy consumption and the costs incurred for lighting has been cut down with the use of smart lighting system. The system allows the users to personalize the lighting and temperature by the use of smart phone applications. The system serves as a pathway that is capable of capturing anonymous data on room occupancy, temperature and humidity through built-in sensors, which in turns helps the managers for

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usage and adjustments. The system allows making intelligent decisions with exceptional levels of energy and operational efficiency.

III. HARDWARE

NODE MCU (ESP8266)

The NodeMCU ESP8266 development board comes with the ESP-12E module containing the ESP8266 chip having TensilicaXtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects. NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.

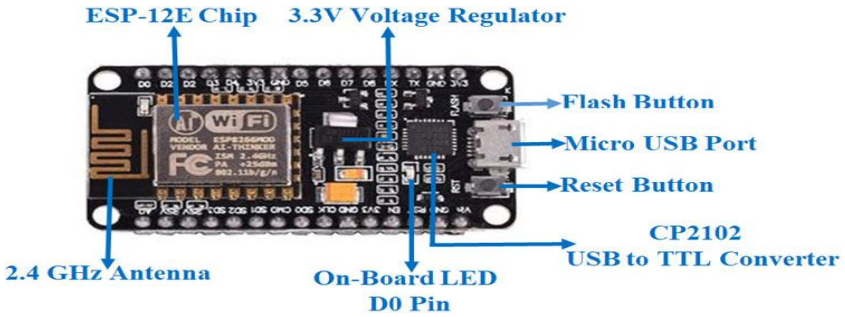

Fig 1 Node MCU

IR SENSORS

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature above around five degrees Kelvin) gives off infrared radiation.

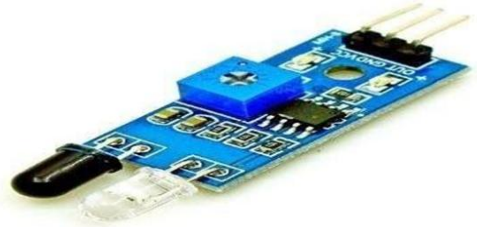

Fig 2 IR SENSORS

SERVO MOTOR

SG90 servo motor is the cheapest servo motor available on the market. Servo motors are used to lift the gates at entry of the parking area. A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision

Fig 3 SERVO MOTOR

LDR SENSOR

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LDR (Light Dependent Resistor) is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.Light Dependent Resistors (LDR) are also called photo resistors.When the LDR is in darkness, then it can be used to turn ON a light or to turn OFF a light when it is in the light.

Fig 4 LDR SENSOR

LEDs

A light-emitting diode is a semiconductor light source. Leds are used as indictor lamps in many devices and are increasingly used for lighting. It emits light when current flows through it. Electrons in the semiconductor recombine with electron_holes, releasing energy in the form of photons LEDs are used in many electronic devices as indicator lamps, in automobiles as rear-window and brake lights, and on billboards and signs as alphanumeric displays or even full-colour posters.

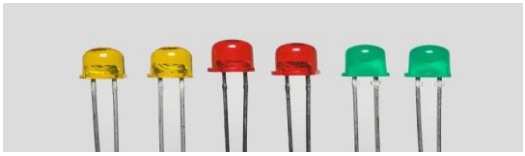

Fig 5 LEDs

MQ135 GAS SENSOR

The MQ-135 Gas sensor can detect gases like Ammonia (NH3), sulfur (S), Benzene (C6H6), CO2, and alcohol. Similar to other MQ series gas sensor, this sensor also has a digital and analog output pin. When the level of these gases goes beyond a threshold limit in the air the digital pin goes high. The analog output pin outputs an analog voltage which can be used to approximate the level of these gases in the atmosphere.

Fig 6 MQ135 Gas sensor

BLOCK DIAGRAM

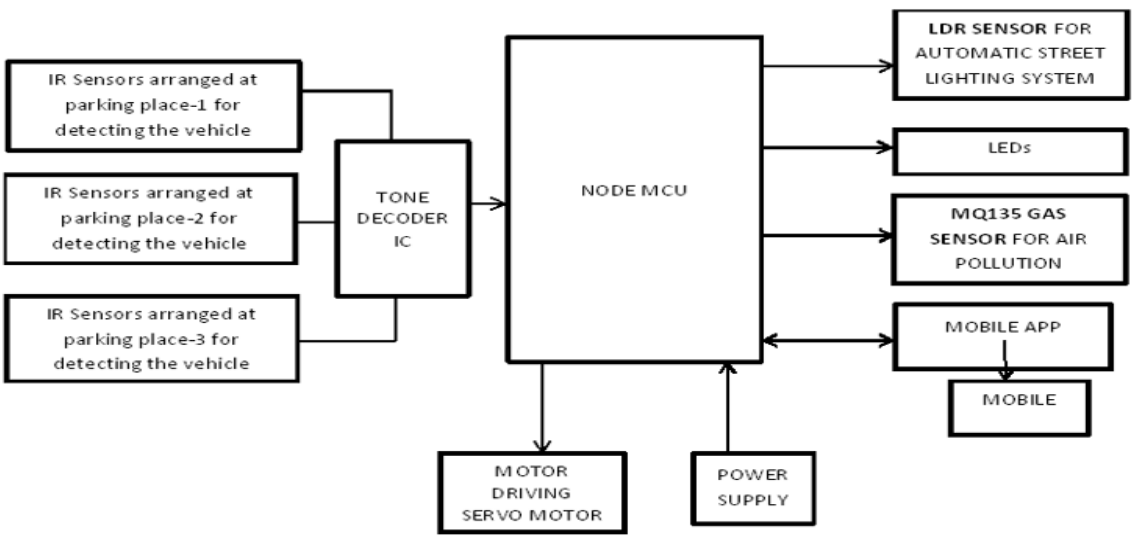

Fig 7 Block Diagram

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IV. SOFTWARE

ARDUINO IDE SOFTWARE

It's free software that allows us to develop and upload code to Arduino devices. This software can be run on many operating systems or platforms such as windows, Linux, and Mac OS. C and C++ have supported programming languages. This software combines standard inventor tools into a single user interface for creating apps for several operating systems. It is very similar to C Language and it is based on a hardware programming language named processing. An Arduino IDE is required for uploading the sketch on the board.

SOFTWARE SERIAL

The Arduino hardware has built-in support for serial communication on pins 0 and 1 (which also goes to the computer via the USB connection). The native serial support happens via a piece of hardware (built into the chip) called a UART. This hardware allows the Atmega chip to receive serial communication even while working on other tasks, as long as there room in the 64 byte serial buffer.

The SoftwareSerial library has been developed to allow serial communication on other digital pins of the Arduino, using software to replicate the functionality (hence the name "SoftwareSerial"). It is possible to have multiple software serial ports with speeds up to 115200 bps. A parameter enables inverted signaling for devices which require that protocol.

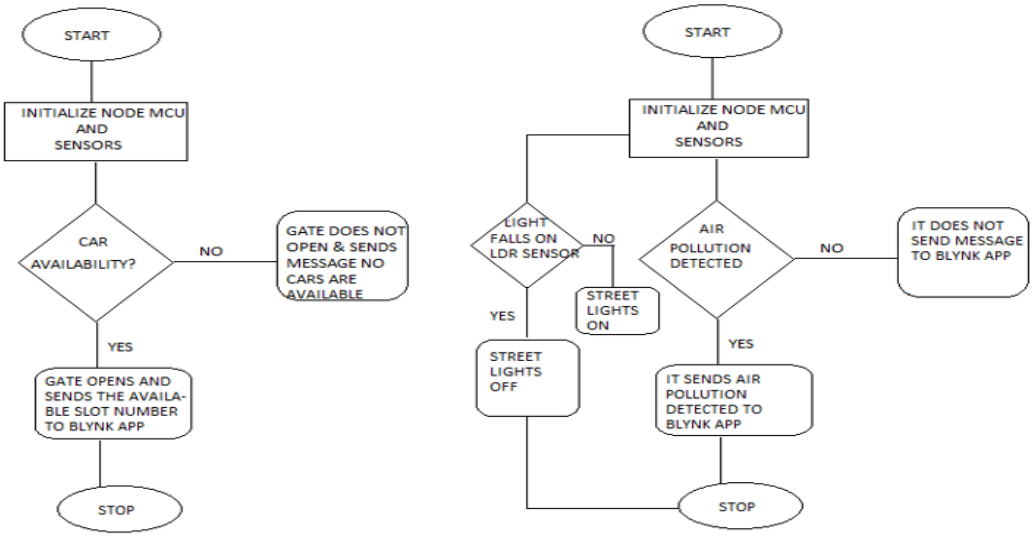
V. METHODOLOGY

In this project we are using NodeMCU, IR sensors, servomotors, LDR sensor, LEDs, MQ135 Gas sensor. NodeMCU is an open source IoT platform .It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware, which is based on the ESP-12 module.

One IR sensor is used at entry gate to detect the car while three IR sensors are used to detect the parking slot availability. Servo motors are used to open and close the gates according to the sensor value. As soon as the IR sensors get the presence of a car in front of the entrance, it will send signal to the NodeMCU to check if there is an empty slot inside the parking lot. When NodeMCU acknowledges that there is an empty slot or more then it will send a signal to the dc servo motor which will open the main entrance. On the other hand if a NodeMCU encounters no empty slots at the time of a car trying to make an entrance, the gate will just not open. In addition, there will be a website linked with the NodeMCU board to show the number of parking.

LDR sensor and LEDs are connected to the NodeMCU. LDR sensor automatically switches ON lights when the sunlight goes below the visible region of our eyes and it automatically switches OFF lights when the sunlight falls on it.

MQ135 gas sensor is connected to NodeMCU and it senses harmful gases present in the environment. It is connected to Blynk app and will send a message when it detects any harmful gases in the air like c02, smoke, alcohol, benzene etc .



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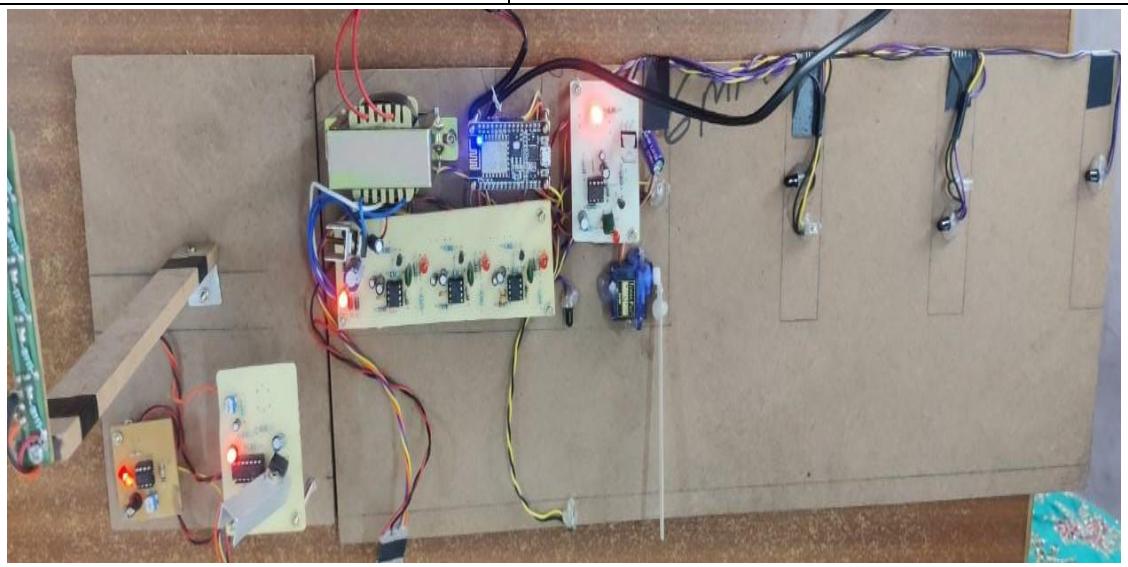
VI. RESULTS AND DISCUSSION

In this IOT based working model, all the sensors are connected to Node MCU Wi-Fi module and a blynk app which is specially designed for IoT projects should be installed in user mobile for notifications and monitoring the appliances. In this project we have worked on three applications smart parking system, air pollution monitoring and automatic street light system. Information about the parking availability and detection of harmful gases in environment are notified to users through messages in blynk application. And street lights are monitored using LDR sensor.

TABLE 1 Parking Availability Using Blynk App

AVAILABILITY OF CARS	RESULT IN BLYNK APP
When slot 1 is full	It opens gate and shows "WELCOME AVAILABILITY CAR SLOT 2 3"
When slot 2 is full	It opens gate and shows "WELCOME AVAILABILITY CAR SLOT 1 3"
When slot 3 is full	It opens gate and shows "WELCOME AVAILABILITY CAR SLOT 2 1 "
When slot 1 2 is full	It opens gate and shows "WELCOME AVAILABILITY CAR SLOT 3"
When slot 2 3 is full	It opens gate and shows "WELCOME AVAILABILITY CAR SLOT 1"
When slot 3 1 is full	It opens gate and shows "WELCOME AVAILABILITY CAR SLOT 2 "
When slot 1 2 3 are full	It does not opens gate and shows "SORRY THERE ARE NO SLOTS"



RESULTS SHOWING SMART PARKING SYSTEM

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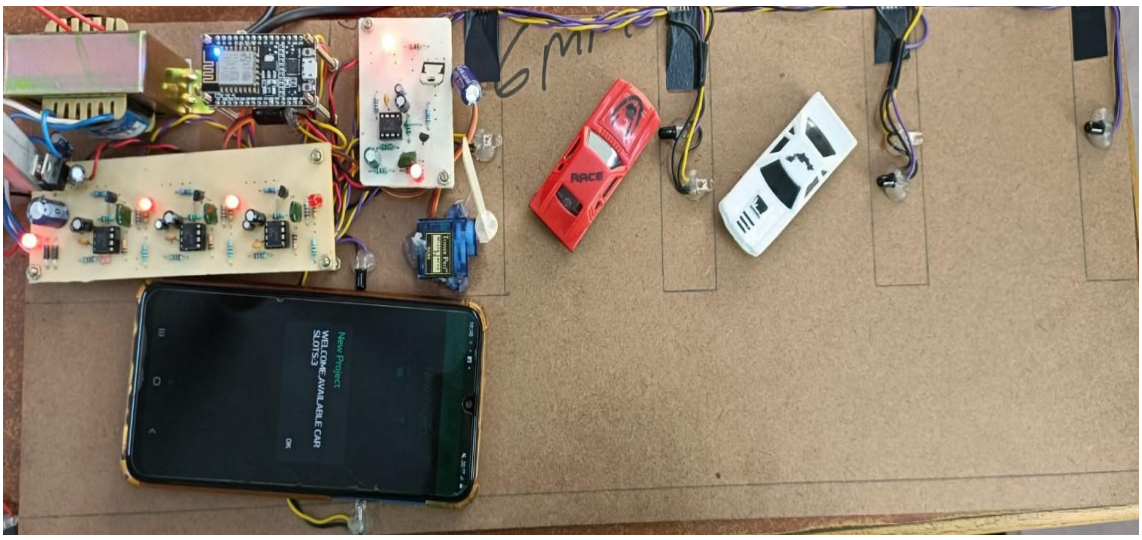
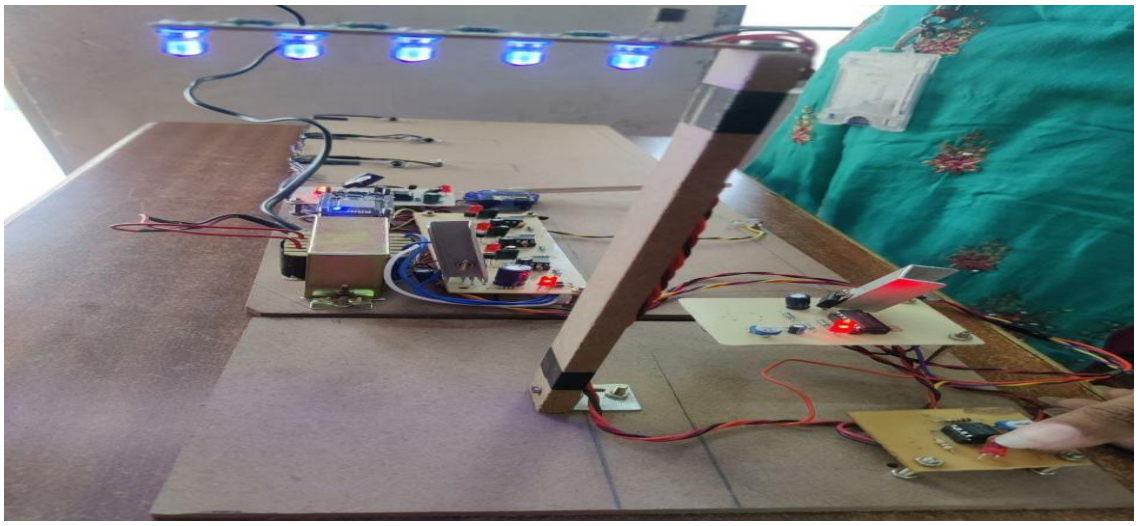
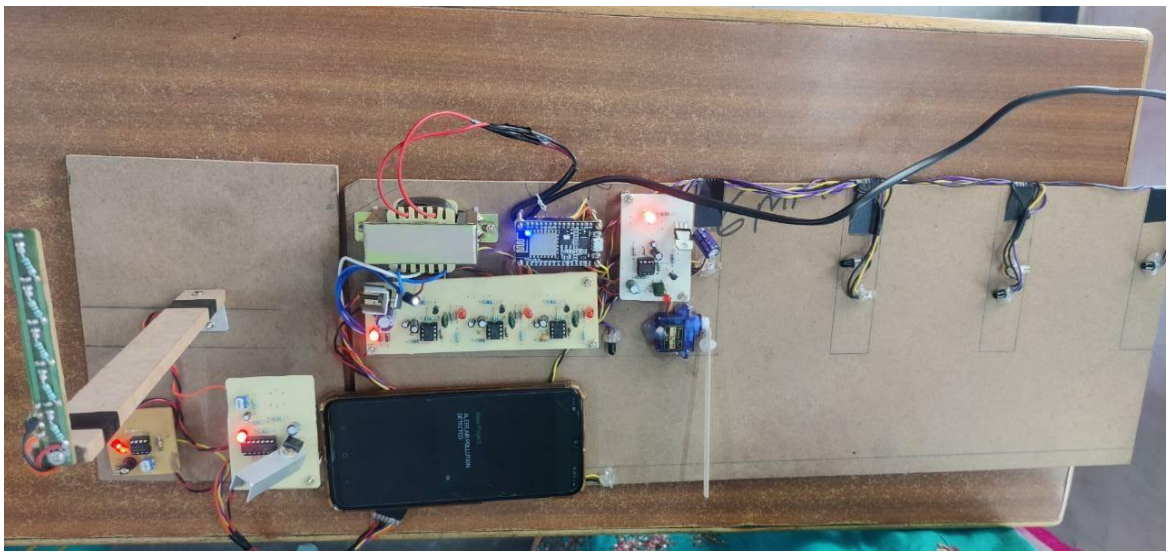


RESULTS SHOWING AUTOMATIC STREET LIGHT SYSTEM



LDR sensor automatically switches ON lights when the sunlight goes below the visible region of our eyes and it automatically switches OFF lights when the sunlight falls on it.

RESULTS SHOWING AIR POLLUTION MONITORING



When MQ135 Gas sensor detects any gases it sends “Air pollution detected to Blynk application”

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VII. CONCLUSION

The concept of Smart Cities has always been a dream for humanity. Since the past couple of years ago large advancements have been made in making smart cities a reality. The growth of Internet of Things and Cloud technologies has given rise to new possibilities in terms of smart cities.

Cities have been an important settlement that effects the environmental changes radically. The rate of resource consumption in contemporary cities is high which raises a question on the sustainability of cities in the near future. Smart City could be viewed as an environment of open and technology drive platform that mitigates the existential problems and challenges faced by its citizens for ensuring a better quality of life. This paper reviews the concept of smart city stemmed from the technologies of Information Society as a potential solution to overcome the issues of the future cities. The attempt to incorporate Information and Communication Technology as a key strategy to mitigate the environmental problems while increasing the efficiency and optimizing the cost makes the city smarter i.e. the deployment of connected solutions to create a city is truly smart.

VIII. FUTURE SCOPE

In future, Smart City technologies are likely to expand in scope and revolutionize areas such as:

- Health care
- Education
- Policing

While also supporting the growth and development of engaged residents capable of understanding and utilizing digital solutions and services ("Smart Citizens")

IX. ACKNOWLEDGEMENTS

We would like to thank our guide Dr. Ch. Sreenivasa Rao Professor, for his continuous support and guidance given to us to complete our project work successfully. We would like to convey our heart full thanks to Dr. B.L. RAJU, Principal of the college, for the wonderful encouragement given to us to move ahead the execution of this project.We are grateful to thank Dr. P. Sathish kumar, Head of the Dept. of ECE, for this thought, provoking suggestions and constant encouragement that led us to this success.

X. REFERENCES

[1] J. Jin, J. Gubbi, S. Marusic and M. Palaniswami, "An Information Framework of Creating a Smart City
[2] through Internet of Things", IEEE Internet of Things Journal, 1(2), 2014, pp 112-121. doi:
[3] https://doi.org/10.1109/JIOT.2013.2296516.
[4] Dr Y Raghavender Rao,"Automatic Smart Parking System using Internet of Things (IOT)" International Journal of Engineering Technology Science and Research, Vol. 4, No. 5, pp. 225-258, May2017.
[5] H. Arasteh, V. Hosseinnezhad, V. Loia, A. Tommasetti, O. Troisi and M. Shafie-khah, P. Siano "Iot-based Smart Cities: a Survey"
[6] Batty, M., Axhausen, K., Fosca, G., Pozdnoukhov, A. Bazzani, A., Wachowicz, M., y otros. (2012). Smart cities of the future.
[7] https://www.researchgate.net/publication/329586966_A_Survey_Smart_Cities_for_Sustainable_Future
[8] https://www.academia.edu/29682314/A_Project_Based_Lab_Report_On_STREET_LIGHT_USING_LDR_A_mini_project_work_on_Anolog_electric_circuit_design
[9] https://bbrc.in/iot-based-pollution-monitoring-system-for-effective-industrial-pollution-monitoring-and-control/