

IOT BASED DATA ACQUISITION METHOD AND MONITORING SYSTEM FOR SMART CITIES

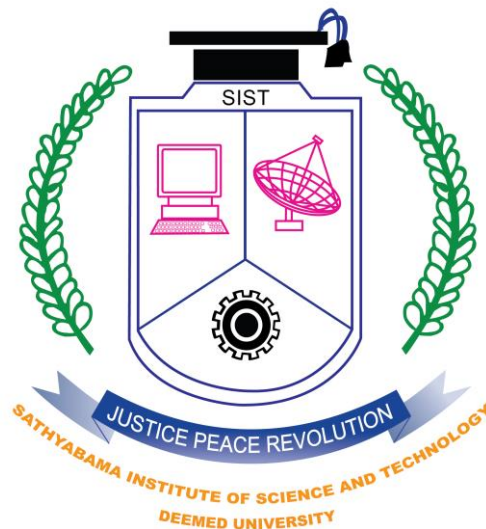
Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering

by

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

APRIL 2023



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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS
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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafide work of
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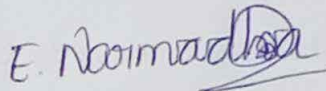
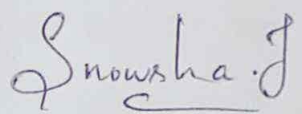
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DECLARATION

We, **NARMADHA.E** (Reg. No. 39140033) and **SNOWSHA.J** (Reg. No. 39140054) hereby declare that the Project Report entitled "**IOT BASED DATA ACQUISITION METHOD AND MONITORING SYSTEM FOR SMART CITIES**" done by us under the guidance of **Dr. V.SIVACHIDAMBARANATHAN** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronics Engineering.

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ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. N. M. Nandhita., Dean, School of Electrical and Electronics Engineering** and **Dr. V. SIVACHIDAMBARANATHAN, Head of the Department, Dept. of Electrical and Electronics Engineering** for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide **Dr. V. SIVACHIDAMBARANATHAN** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of **Electrical and Electronics Engineering** who were helpful in many ways for the completion of the project.

ABSTRACT

The main purpose of this project is to monitor the environment parameters with best accuracy by using temperature sensor , Humidity sensor ,pollution sensor, LDR sensor Zig bee module ,power supply , microcontroller , Wi-Fi module .This system includes cloud server which is a virtual server that operates in a cloud computing environment it is created ,hosted and provided via the internet through a cloud computing environment it is created ,hosted and provided via the internet through a cloud computing infrastructure that can be accessed from any place .

The project presents a framework for the realization of smart cities through the internet of things. The main goal is to achieve a sustainable development ,increase the quality of life of its citizens and improve the efficiency of the existing and new infrastructure.This paper presents an abstract of IoT-based data acquisition and monitoring system for smart cities. The proposed system includes various components such as sensors, wireless communication networks, cloud-based data storage, and analytics tools. The system collects data from various sources such as traffic sensors, weather sensors, air quality sensors, and smart energy meters. The collected data is transmitted wirelessly to a central database where it is stored and processed. The processed data is then analyzed using advanced analytics tools to extract actionable insights, which can be used to optimize resource allocation, improve city services, and enhance the quality of life for citizens.

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LIST OF SYMBOLS AND ABBREVIATIONS

LM393 IC-GAS SENSOR

DHT11-TEMPERATURE AND HUMIDITY SENSOR

V_{cc}-VOLTAGE COMMON COLLECTOR

IOT-INTERNET OF THINGS

ICT-INFORMATION AND COMMUNICATIONS TECHNOLOGIES

LDR-LIGHT DEPENDENT RESISTOR

RFID-RADIO-FREQUENCY IDENTIFICATION

MBSE-MODEL BASED SYSTEMS ENGINEERING

ITS-INTELLIGENT TRANSPORTATION SYSTEMS

STSC-SMART TRAFFIC SIGNAL CONTROL

RE-RENEWABLE ENERGY

AI- ARTIFICIAL INTELLIGENCE

EU-EUROPEAN UNION

RH-RELATIVE HUMIDITY

LR-WPANs - LOW-RATE WIRELESS PERSONAL AREA NETWORKS

SOA-SERVICE-ORIENTED ARCHITECTURE

PTP- PRECISION TIME PROTOCOL

UART-UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER

HVAC-HEATING VENTILATING AND AIR CONDITIONING

NTC-NEGATIVE TEMPERATURE COEFFICIENT

PCB-PRINTED CIRCUIT BOARD

NOR-NUCLEOLUS ORGANIZER REGIONS

SPICE-SIMULATION PROGRAM WITH INTEGRATED CIRCUIT EMPHASIS

CHAPTER 1

INTRODUCTION

1.1 GENERAL INTRODUCTION

The requirement and effectiveness of making cities smarter, about the potential market size, about trials and tests. Increasing population density in urban centers demands suitable provision of services and infrastructure to meet the needs of city inhabitants, surrounding residents, workers the increasing and visitors. Increasing need is the being felt for smart city which are both efficient ,sustainable and can generate economic prosperity and social well being. The utilization of information and communications technologies (ICT) to achieve this objective presents an opportunity for the development of smart cities, where city management and citizens are given access to a wealth of real time information about the urban environment upon which to base decisions, actions and future planning. This project presents a framework for the realization of smart cities through the Internet of Things (IOT). The vision of smart cities is the urban center of the future made safe, secure environmentally because all structures-whether for power water, transportation etc. The framework encompasses the complete urban information system, from the sensory level and networking support structure through to data management and Cloud based integration of respective systems and services, and forms a transformational part of the existing cyber-physical system. This IOT vision for a smart city is applied to a noise mapping case study to illustrate a new method for existing operations that can be adapted for the enhancement and delivery of important city services.



Fig : 1.1 smart cities

Smart cities are looking to leverage data generated by systems and processes deployed in cities for curating business intelligence and improving their operational efficiency. Bringing data in 'focus' ensures a move towards outcome-based planning in governance. "With big data analytics, public transport can be optimized to make transits as short as possible. Data analysts can investigate trends in city data that can help reduce traffic congestion and also assist authorities in developing smarter ways to manage the traffic in the city. The approach to the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions.

The study designs a smart urban environment monitoring system based on the wireless network of Zig Bee to complete the real-time collection of urban environment information. The system consists of the basic monitoring network and the remote receiving terminal. The basic monitoring network connects the streetlights as routes and the taxis as nodes. After dynamically organizing the network, each node is assigned with an address as the only identity in the network. Then the system designed conducts the simulation experiment to prove that it could meet the needs

and send the collected information to the designated terminal in the form of message according to the setting. The sensor organized through the wireless network of Zig Bee could inspire the infrastructure construction of the smart city. With the network, a smarter and more comfortable society could be well offered to people.

1.2 MOTIVATION FOR SELECTION OF THIS PROBLEM

Data acquired in a smart city might identify severely impacted locations and what sort of renovations are required using big data analytics. Investments in the appropriate domains can be made based on thorough analysis. The massive deployment of internet of things is allowing smart city projects and initiatives all over the world. Whereas IoT deals with intricate systems that integrates multiple disperse components towards their synergetic use. Due to resource constraints, there will be a problem in the future to provide all the services to the residents. To continue to serve and improve the standard of living of the growing population, it is necessary to develop smart cities. Moreover, IoT based monitoring systems can provide continuous surveillance of various parameters such as temperature, humidity, pressure, and motion, among others. This can help to detect and prevent potential problems before they occur, reduce downtime, and improve overall efficiency and productivity. The Smart City aims to make optimal and sustainable use of all resources, while maintaining an appropriate balance between social, environmental and economic costs. The wireless sensors are attached to street lamp, water tank, dustbin. Sensors are then attached to Arduino microcontroller board where each and every necessary parameter for city are monitored and updated to cloud. The technology we use is IOT in this model a system of interconnected smart modules is developed where each and every parameter necessary for a city is monitored and updated to the cloud. Emphasis is given on how sensing and communication technologies of IoT can effectively be used in smart city monitoring.

Overall, the motivation for this project to developing a system which facilitates aids in collection of data with the help of interconnected modules consisting of multiple

sensors (Rain sensor, Temperature sensor, Humidity sensor, LDR sensor, Gas sensor) useful for smart city monitoring.

1.3 OVERVIEW

To develop an IoT system, a thing is required which should be equipped with necessary sensors, actuators and a communication interface. The communication interface is needed to connect the thing to the internet that allows them to send the data to cloud or at remote machine for monitoring and also for analytics purpose. The thing can also receive the control information based on some analytics and take some actuating decision. The introduction of IoT (Internet of Things) establishes the platform for the world to showcase hi-tech machine-to-machine interaction ranging from connected cars to smart cities to weather monitoring systems and smart homes. The IoT revolution is transforming the way humans interact with machines. When objects like an environment furnished with sensor devices, microcontrollers, and different software applications become a self-monitoring and self-protecting environment, it is called a smart environment. Similarly, here, the system uses sensors to monitor and adjust environmental parameters such as temperature, CO levels, and relative humidity. Then, it sends the data to a web page to plot the sensor data, shown as graphical statistics. The data updated from this system can be accessed on the internet from anywhere in the world criteria and store the data in the cloud IoT is the core root of linking all the sensors to the internet and monitoring the weather in real-time.

CHAPTER 2

LITERATURE SURVEY

2.1 MAJOR FINDINGS FROM LITERATURE SURVEY

Andréa Claudia Erban et.al., [1] explained about one of the most challenging areas of Future Smart Cities Research is the Smart Energy domain. Critical issues related to optimization, provision of smart customizable networks and sophisticated computational techniques and methods enabled by artificial intelligence and machine learning need further investigation. The renewable energy (RE) is a powerful resource for the future global development in the context of climate change and resources depletion. Artificial intelligence (AI) implies new rules of organizing the activities in order to respond to these new requirements. It is necessary to improve the design of the energy infrastructure, the deployment and production of RE in order to face the multiple challenges that will affect the sector's growth and resilience. In this research work we exploit the recent developments on the AI adoption for RE sector in European Union (EU). In this respect, we analyzed (i) the efficiency of the transformation processes of the RE within the energy chain from Gross Inland Consumption to Final Energy Consumption, (ii) its implications on the structure of renewable energy by source (solar, wind, biomass etc.), (iii) the labor productivity in RE sector compared to the economy as a whole and its correlation with investments level, (iv) the implication of the adoption of AI for RE towards Future Smart Cities Research. The main contribution of this research is the development of a framework for understanding the contribution of AI in the RE sector in Europe. Another bold contribution of this work is the discussion of the implications for Future Smart Cities Research and future research directions.

Andrzej Rucinski, Raymond Garbo's et al., [2] analyzed with focus on Smart City Efforts described introduce the concept of human centered scalable ecosystem development which is driven by 5G/IOT paradigm and follows the philosophy of disruptive innovation. The development cycle includes both the process and the implementation of an ecosystem. The process is based on the service science

collaborator framework and illustrated by the description of US-based e Collaborative Ventures (e CV) Collaborator incorporated in the state of New Hampshire, United States. The ecosystem development is focusing on the building smart cities and is illustrated by the description of a leading 100 smart cities project of India. The human factor aspect of these ecosystems emphasizes the attractiveness of the described approach for the creation of a modern Cyber society with balance among society, technology and spirituality. Today's Central and Eastern Europe with conferences such as IDAACS is a perfect ground to consider the proposed solution for not only the restoration of traditional scientific and economic relations but also for building innovative ones suitable for the challenges of the European Union. The IoT laboratory has developed an open source IoT based design and application environment enabling a seamless integration of user-defined applications into the system.

Arthur Souza et al., [3] discussed a central issue in the context of smart cities is how to analyze a large amount of data generated by different kinds of sources in real time. This paper reports a case study in real-time acquisition of crime detection information from social media messages, built on top of a platform for fast processing and visualization of data from Twitter. The purpose is to allow city managers to act timely on preventing crime occurrence as detected from tweets posted by real users. Key issues here are the processing of a large volume of data and modularization and customization capabilities implemented through pipelined modules for robust, fast, real time tweet acquisition and storage. In particular, the customization is reflected by modules of filtering of several kinds, natural language processing tasks, topped by a machine learning analysis that allows for the classification of the input messages according to the local policy category system.

Claudiu Lung, Attila Buchman et al., [4] described the problem of emergency situations management is a very actual and “hot” topic for big cities. A prompt and a robust response action in this situation is needed and smart cities should provide to citizens protection. Therefore, many research programs are made on this field. The main goals for the researches are to create, implement and develop different types of sensor networks, to be able to predict, prevent and react fast and efficiently on

dangerous situations. In general, the final results are limited on data acquisition process and database operations, for statistics or monitoring applications. Based on this idea, the studies and research that will be presented in this paper, are focused on implementing, optimize and test various configurations of smart sensors networks, that are able to collect and store data from various sensors, from an extended area like a city, suitable with "IOT Smart city".

Dr. Sanjeev Sharma¹ et al., [5] In this Traffic congestion introduced major problem in rapidly expanding cities (in terms of population) of India which drastically increase air pollution, Fluid consumption as well as vehicular density. This necessitates to find a new way for controlling traffic system. This has been managed through real time traffic density management using IOT. An intelligent traffic management system has been designed to control traffic system which includes components consisting of raspberry pi, IR sensor, LCD display. Raspberry pi is the key component which is used to control all performance multitasking. IR sensor is used to monitor the density of traffic. The corresponding data are then made available on website in order to display the traffic status so that people will get early update and can avoid the traffic jams.

Ebenezer Okai et al., [6] The project discussed about partly funded by the Higher Education Funding Council for England and led by The Open University with the primarily aim of developing innovative solutions to support the economic growth in Milton Keynes [MK Smart]. MK Data Hub is the central infrastructure to the project which supports the acquisition and management of the big data from various data sources relevant to the city systems. [MK Smart, 2014]. Whilst the data plays crucial part to this project, the forensic value of the data held is also important to the investigation of this project. Data might be required to help in any forensic investigation to be proven in a case of Data integrity. The challenges of security and forensics to this project may be hindrance to its future. Mitigating these challenges can go a long way not only to this project but to other smart cities projects. This paper concentrates on realizing the security and forensics challenges of the MK Smart project, primarily looking at the challenges of securing such a huge amount of data on

a data hub and concentrating on the best possible way to forensically investigate the large complex data such as the data stored on the Data hub.

Hadi Habibzadeh et al., [7] discussed about today's existing smart city research involves many overtly futuristic applications such as smart transportation, in which smart roads warn drivers of bad traffic conditions ahead, smart parking, which communicates the location of unoccupied parking spaces to drivers, and smart environment, which enables fully automated homes and workplaces to adjust their temperature to conserve energy. Despite its seemingly insurmountable size, the acquired data is highly redundant, and systematic use of machine intelligence and data analytics can facilitate processing by extracting only the relevant information; in this article, we study the role of these algorithms through the lens of the 3Vs in facilitating soft sensing within the framework of smart city applications.

James P.G. Sterbenz et al., [8] introduced a Challenges, Modeling, and a Survey of Research Opportunities the IOT (Internet of things) is emerging as a wide variety of devices are attached to the Internet to support ubiquitous and pervasive sensing and computing, home automation, and the shift toward smart cities. This invited paper discusses the challenges, modeling, and research opportunities in achieving resilience in the Future Internet incorporating the IOT in the context of smart cities. The Global Internet is already an extremely complex Multi realm multilevel network that is difficult to understand and model; we define a realm to be a policy, trust, or mechanism boundary, The incorporation of the IOT in the context of smart cities significantly increases this complexity, not only in the number of nodes and structure, but also in the increased heterogeneity of protocols and mechanisms

Li Xia et al., [9] described a new data acquisition methods in smart city, such as smart mobile phones, RFID, sensors, two-dimensional code, can obtain the object information in real-time. Storage and analysis for big data are challenges for smart city. Based on concept of Intelligence information service of smart city, this paper analyzes the interactive relationship among the government, business and public which focus on technology and infrastructure. Then, builds T-IGBP value network model and puts forward the framework model of Intelligence information service for smart city, in order

to solve the problem for accurate information transmit to the right target at accurate time and right place. Finally, the challenges that smart city Intelligence information service are proposed in future. such as data availability, data privacy, the limited ability for cross-functional communication and so on. The last one means government who offers policy support and standardizes systematic management. Knowledge base (server-side) are in charge of treatment of past data for users, establishment and maintenance of knowledge base, information service demands identification and intelligent requesting function, while terminals (clients) keep listening and tracking users' real-time status and receiving services.

Matthew Hause et al., [10] described including technology advancements and revenue generating potential across the business spectrum, is dependent on the application of robust Systems Engineering processes, methods, and tools. Without Model Based Systems Engineering (MBSE), the complexity involved in the design, development, and deployment of IOT systems would require more system and operational providers' resources. Regardless of any industry standards, IOT systems cannot be built in a vacuum. Technology advancements in consumer products will continue to evolve to facilitate connection to IOT networks. This will be the catalyst for driving entire infrastructures changes to: federal, state, city, and local authorities and governments; product development companies; utility and service providers; and even to consumers. The infrastructure and management setup needs to be adopted prior to create smart systems. Smart system by a traffic management system and its connected systems, as well as how a MBSE approach can help.

Sumit N Shukla et al., [11] discussed about IoT is a revolutionary technology that aims to make every single device internet ready. Its concept revolves around integrating various technologies to build M2M interaction possible rather than U2M interaction. Smart city is a broader vision that aims to uplift the quality of life of every individual by integrating modern Information and Communication Technology (ICT) and internet of things. Devices used in smart city can generate huge amount of data that must be properly collected, routed and stored to perform further analysis on it. Hence data collection is an important aspect in building smart city, we have

discussed about various ways of data collection in smart transportation, one of the domains of smart city. To provide vital information pertaining to each data collection way in a summarized way. From the tabular representation shown above, we can say that data collected from various sources in smart transportation environment is heterogeneous in nature and this collected data should be converted into some common format to be stored as Big Data for further data analysis by applying various approaches to get some useful information out of it.

These are past study projects on various systems using various technologies for environmental protection.

Truong Khanh Duy et al., [12] proposes the Internet of Things (IOT) is an emerging paradigm that involves both industry and academic communities. In term of smart cities, IOT plays an essential role in the technological development applied to society to improve life quality. In several application fields such as environmental monitoring, using the concept of the sensors network to produce data is also considered as the Internet of Things platform for data producing. In the race of designing IOT as a part of the Future Internet architecture, Information and Communication Technology (ICT) industry and academic communities have realized the crucial problem in IOT is the interoperability of the information and services

Vladimir Zdraveski et al., [13] introduced a prototype application was developed for the city of Skopje, Macedonia. According to a United Nations report, 54 percent of the world's population lives in urban areas; by 2050, it could be 66 percent.¹ Managing urban areas is thus becoming one of the most important development challenges of the 21st century. Furthermore, forecasters predict there will be approximately 30 billion connected things by 2020. These connected things (sensing devices) might include wearable sensors;

Wei-Hsun Lee and Chi-Yi Chiu et al. [14] Proposed a Infrastructure supporting vehicular network (V2X) capability is the key factor to the success of smart city because it enables many smart transportation services. In order to reduce the traffic congestion and improve the public transport efficiency, many intelligent transportation

systems (ITS) need to be developed. In this paper, a smart traffic signal control (STSC) system is designed and implemented; it supports several smart city transportation applications including emergency vehicle signal preemption, public transport signal priority (PTSP), adaptive traffic signal control, eco-driving supporting, and message broadcasting. The roadside unit controller is the core of the proposed STSC system, where the system architecture, middleware, control algorithms, and peripheral modules are detailed discussed in this paper. It is compatible with existed traffic signal controller so that it can be fast and cost-effectively deployed. A new traffic signal scheme is specially designed for the scenario, it can inform all the drivers near the intersection regarding which direction the emergency vehicle (EV) is approaching, smoothing the traffic flow, and enhancing the safety. EVSP scenario and the related control algorithms are implemented in this work; integration test and field test are performed to demonstrate the STSC system

Yufei Fang et al., [15] this paper proposes a 'two-dimension, three-layer, and six-goal' top-level design model for a smart city, with six principles for a smart city operational pattern, and focuses on three key technologies: (1) infrastructure integration and application, (2) multidimensional perception data collection and aggregation, and (3) intelligent data analysis and data service. Following the guidance of this model, Long gang District of Shenzhen has constructed a smart city operation and management center including integrated ICT infrastructure, an urban management system, and an intelligent urban data analysis and service system. The actual effects and quantitative improvements in the practical case show that the top-level design model of a smart city proposed has achieved successful results, and it thereby offers an applicability model of a smart city that can be referenced and replication.

2.2 INFRENCES FROM LITERATURE SURVEY

- An IoT-based data acquisition and monitoring system can play a crucial role in enabling smart cities to efficiently collect and analyze data from various sources. The system can be designed to collect data from a range of sources such as sensors, and other IoT devices deployed throughout the city. The data collected can then be processed and analyzed in real-time to provide insights into various aspects of the city's functioning, such as traffic flow, air quality, energy consumption.
- One of the primary advantages of an IoT-based data acquisition and monitoring system is that it allows for the continuous collection and analysis of data, which can help in identifying trends and patterns that can aid in decision-making. For instance, if the system detects a pattern of heavy traffic congestion in a particular area, the city authorities can use this information to take remedial measures such as redirecting traffic or improving public transport.
- The monitoring system can also be used to identify potential hazards such as water leaks, gas leaks, or even accidents. This can help in reducing response time and improving the overall safety of the city.

2.3 PROBLEM STATEMENTS

This project focuses on the representation of moving 2D geometric shapes acquired at discrete times using continuous models of time and space. Using morphing techniques based on compatible triangulations, issues regarding the representation of spatiotemporal data in databases, as well as the influence of different design strategies on the fidelity of the approximations with respect to the modeled phenomena, are investigated. An experimental study using synthetic and real data was performed. The findings show that the use of triangulation-based interpolation is a promising approach, because it allows creating continuous

spatiotemporal representations that are more realistic than those obtained using the solutions proposed in previous work. Open issues regarding the representation of spatiotemporal data in information systems are also highlights.

2.4 EXISTING BLOCK DIAGRAM

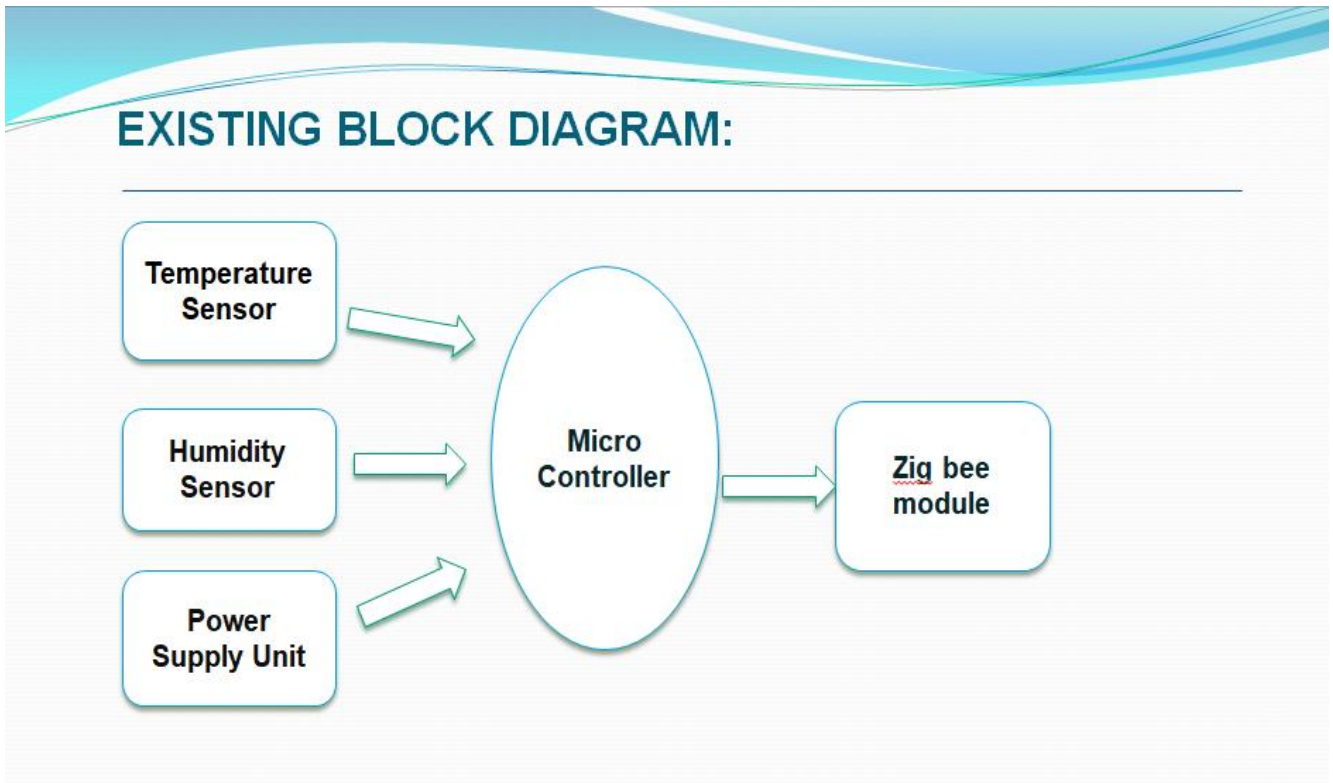


Fig:2.1 Existing block Diagram

Fig 2.1 shown as humidity sensor is a device that senses, measures, and reports the relative humidity (RH) of air or determines the amount of water vapor present in gas mixture (air) or pure gas. A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. Zigbee is a wireless network module that is being controlled globally. It is a low power network and comprise of sensors, control systems and instrumentation. Its benefits are really beneficial for domestic purposes and they can be seen in medical monitoring, industrial automation, low power sensors, HVAC control In existing system we are able to monitor only temperature, humidity, power supply unit,

microcontroller, Zigbee module. Based on that we are able to know temperature and humidity level.

2.5 DISADVANTAGES OF EXISTING SYSTEM

- Limited distance covered.
- Only for monitoring the data.
- Storing the data is not possible.
- There are no more sensors to predict the other environment parameters.

2.6 IEEE STANDARDS

- IEEE 802.15.4: This standard specifies the physical and media access control layer protocols for low-rate wireless personal area networks (LR-WPANs), which are commonly used in IoT applications.
- IEEE 1888: This standard provides a service-oriented architecture (SOA) for the Internet of Things, which can be used to enable interoperability between different IoT devices and applications
- IEEE 1588: This standard defines the Precision Time Protocol (PTP), which can be used to synchronize clocks across multiple microcontrollers and other devices in a networked system.
- 1851-2012-IEEE Standard for design criteria of integrated sensor-based test applications for household appliances.
- 528-2019-IEEE Standard for inertial sensor terminology.

2.7 CONSTRAINTS

The constraints of IoT-based data acquisition and monitoring systems, including connectivity, power supply, data security, interoperability, data management, and cost, can impact the effectiveness and success of such systems when using temperature, humidity, LDR, and rain sensors. Here are some ways in which these constraints can help IoT-based data acquisition and monitoring systems for smart cities:

- **Bandwidth limitations:** IoT-based systems rely on wireless communication technologies, which can have limited bandwidth and range. This can limit the amount of data that can be transmitted and affect the quality of data collected.
- **Network coverage:** The network coverage of IoT-based systems rely on wireless networks, which can have coverage limitations in some areas. This can affect the reliability of the data acquisition and monitoring system and limit its effectiveness.
- **Data storage and processing:** IoT-based systems can generate large amounts of data, which require storage and processing capabilities. This can be a challenge, particularly in resource-constrained environments where devices may have limited memory and processing capabilities.
- **Interoperability and compatibility:** IoT-based systems can be based on different technologies and standards, which can create interoperability and compatibility issues between different devices and systems. This can affect the system's functionality and efficiency.
- **Cost:** IoT-based systems can be costly to implement and maintain, particularly in large-scale deployments. This can be a constraint for organizations with limited financial resources.

2.8 TRADE-OFF

1. Security risks: Improved situational awareness of IoT-based sensors can provide security personnel with real-time information about the city's environment, including temperature, humidity, and other environmental factors that could affect security
2. Complexity: IoT-based data acquisition and monitoring systems can automate various processes, such as data collection and analysis, which can help to reduce complexity by eliminating the need for manual processes.
3. Data overload: IoT-based data acquisition and monitoring systems can use filtering techniques to reduce the amount of data generated by sensors. This can help to reduce data overload by only sending relevant data to the cloud or other data management systems.
4. Increased public safety: By addressing security risks, IoT-based data acquisition and monitoring systems can increase public safety, providing citizens with a safer environment to live and work .

CHAPTER 3

AIM AND SCOPE OF THE PRESENT INVESTIGATION

3.1 INTRODUCTION

The aim of the present investigation is to we are monitoring the humidity, temperature rain, pollution, day or night and also store the data in IoT in the cloud. With that we are using hardware is temperature sensor, humidity sensor, LDR sensor, gas sensor, pollution sensor, rain sensor and microcontroller. We propose a method using IOT where the LDR, IR, Float and humidity sensors values are fed to the microcontroller by means serial communication using UART protocol which is asynchronous means that data is transferred without support from an external clock signal.

Applications connected to the IoT have become interesting areas of research. This testifies to the size and significance of data-related issues that must be resolved in modern commercial enterprises, particularly in cloud computing. Just like network connections, the expansion of cloud is strongly tied to the growth of the IoT. Due to its ability to provide processing power and on demand storage for big data, IoT cloud services have allowed devices to capture, store, and transmit larger and more complex set of data. In this introduction we have power supply with the microcontroller temperature sensor, humidity sensor, rain sensor, LDR sensor, pollution sensor connected to the microcontroller with the help of Wi-Fi. we are storing the data's in to the cloud using relay, we are connected to the dc light. The investigation will also aim to improve its performance efficiency, and reliability.

3.2 OBJECTIVE

The objectives of the proposed work are as follows:

- Effective decision – making based on data
- Improving the environment through various systems
- To reduce both economic and natural input costs.
- Creation of services that respond more effectively to the needs of citizens.

3.3 SCOPE OF THE PROJECT

The work suggests in this work, the design and implementation of many sensors (temperature sensor, humidity sensor, rain sensor, pollution sensor, LDR sensor) collecting data's and send to the cloud and store it, and then we have to monitor the data in the cloud every time in everywhere. In this introduction we have power supply with the microcontroller temperature sensor, humidity sensor, rain sensor, LDR sensor, pollution sensor connected to the microcontroller with the help of Wi-Fi. we are storing the data's in to the cloud using relay, we are connected to the dc light. The investigation will also aim to improve its performance efficiency. IoT based data acquisition systems can be used to collect real-time data from various sensors and devices deployed throughout the city, such as traffic sensors, air quality sensors, water quality sensors, waste management sensors, and energy meters, among others. This data can be used to monitor and manage different aspects of the city, including traffic flow, energy consumption, waste management, and environmental conditions.

Moreover, IoT based monitoring systems can help to detect and prevent potential problems, such as traffic congestion, air pollution, and water contamination, among others. This can help to reduce the negative impact on the environment and improve the quality of life for citizens . Overall, this project aims to contribute to the uses information and communication technologies to increase operational efficiency, share

information with the people and improve both the quality of government services and citizen welfare

3.4 METHODOLOGY

- ❖ Gathering information to know more about Controllers, Sensors and Cloud



- ❖ Gathering information about software's to use in the system for implementation



- ❖ Implementing it in software so, that we can assembly parts virtually



- ❖ Collecting sensor's data from Microcontroller and it will be stored in cloud



- ❖ Implementing the system in hardware and uploading the code into the hardware



- ❖ Checking whether the desired output is coming or not

3.5 PROPOSED BLOCK DIAGRAM

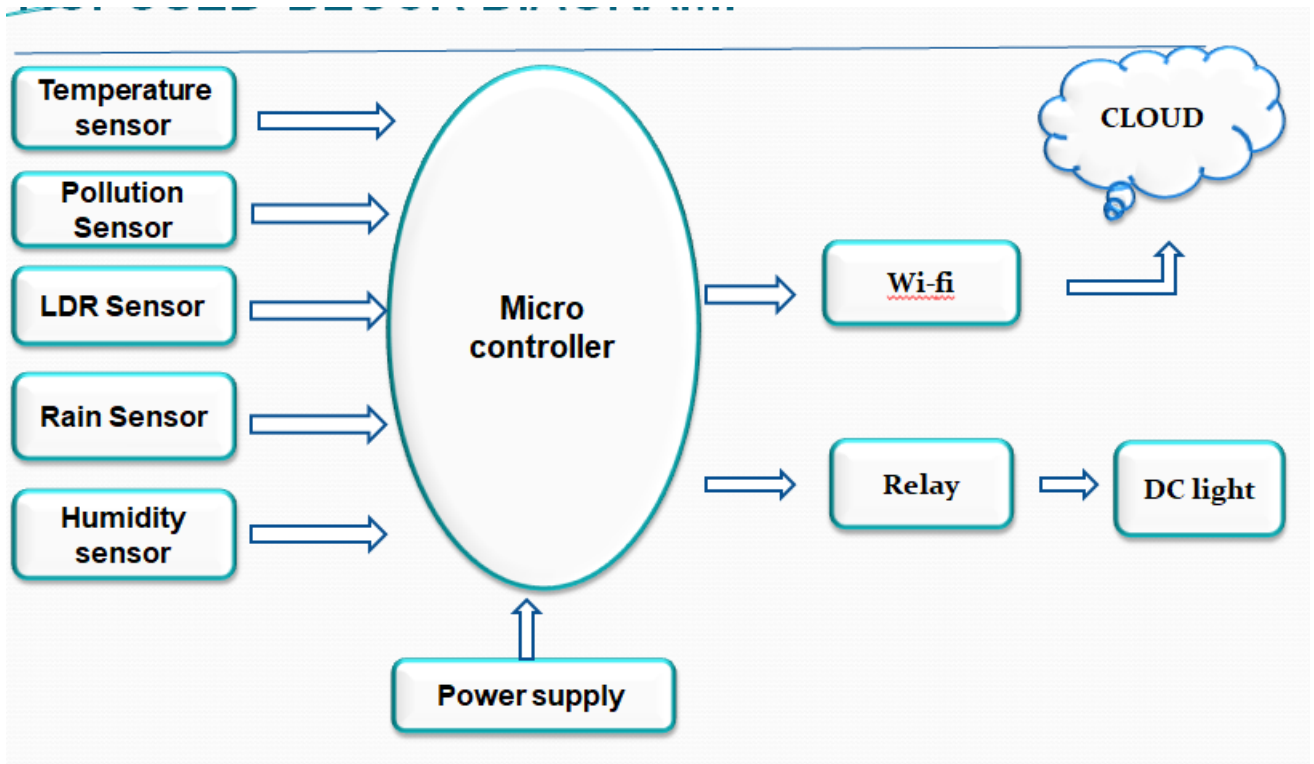


Fig: 3.1 Proposed block diagram

In this fig 3.1 shown as an interface more sensors to know more about the environment parameters with better accuracy and also this system is wireless system. In existing system we are using only temperature sensor, Humidity sensor, Zig bee module. But in this proposed system we are using Pollution sensor, LDR sensor, Rain sensor, Humidity sensor, Power supply, microcontroller, Wi fi module. In proposed system, we can monitor and store the data in cloud server. So, we can identify the changes happening in the environmental parameters.

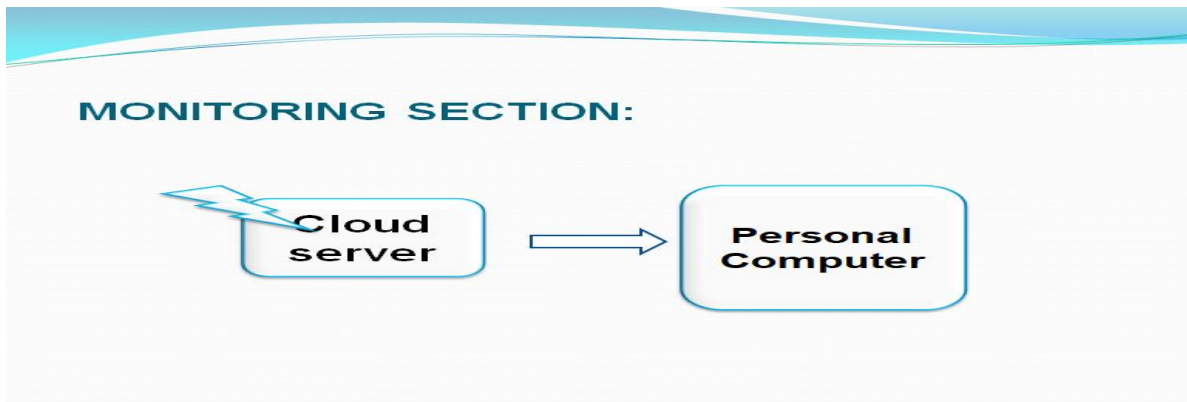


Fig:3.2 monitoring system

A cloud server fig 3.2 shown as rather than being a physical server, is a virtual server that operates in a cloud computing environment. its created, hosted and provided via the internet through a cloud computing infrastructure that can then be accessed from any place. Cloud server are self-contained and come with all of the software they require to function.

3.6 ADVANTAGE OF PROPOSED SYSTEM

- This system will have more sensors to predict the environment parameters.
- Storing the data using cloud server is applicable.
- We included the IoT so that we can analyze the data from anywhere.
- Helps to Store the data for future analysis.
- Enable better services to citizen by managing operations without human interventions.

3.7 APPLICATION

- Air pollution
- Street light
- Natural Disaster Management
- Safer Communication

3.8 FLOWCHART

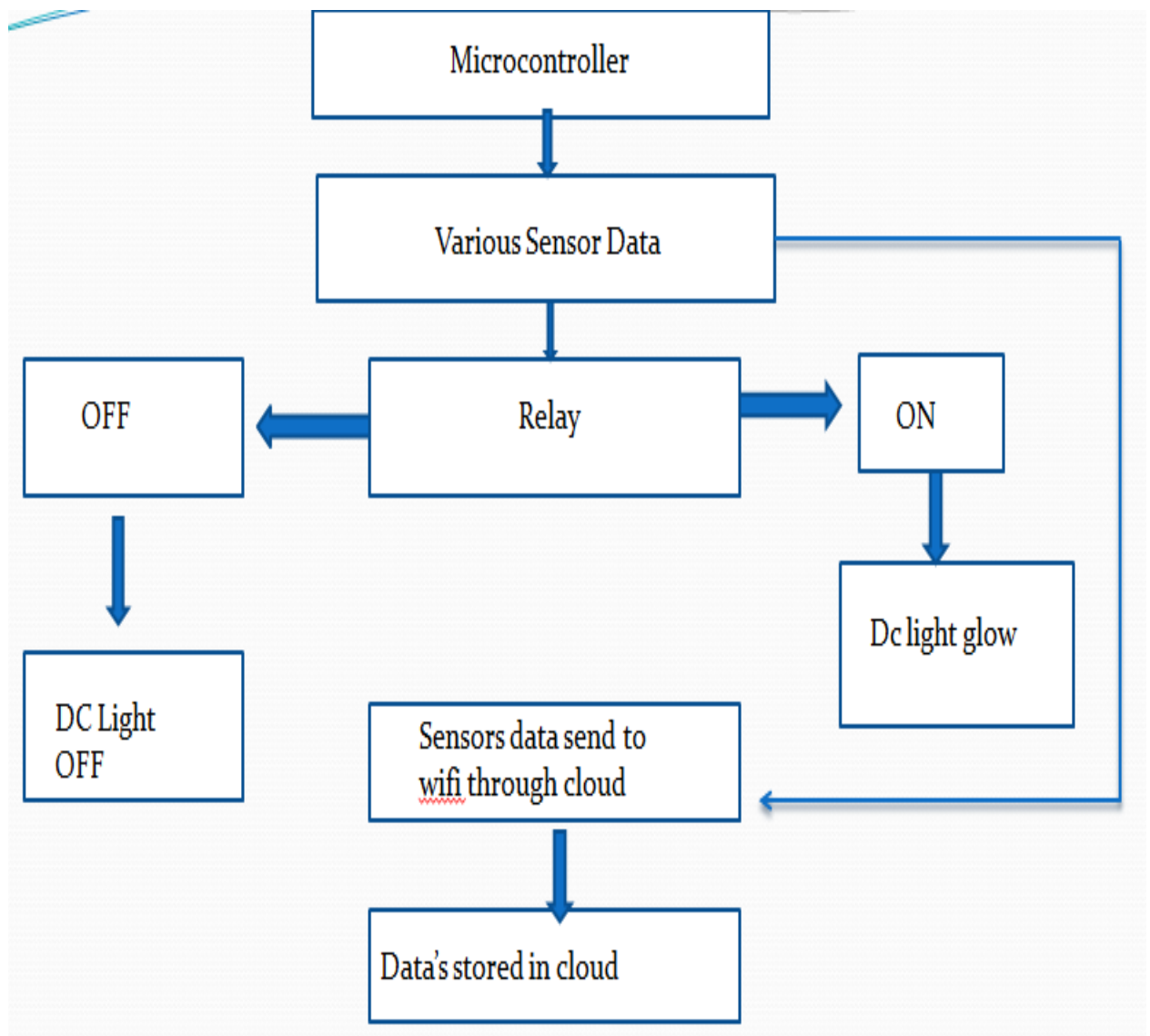


Fig :3.3 flow chart

CHAPTER 4

HARDWARE DISCRIPTION

4.1 INTRODUCTION

The system architecture is covered in this chapter. This part primarily covers the hardware and software requirements. The suitable working environment is set up ,along with all of the components needed to develop the system. The system was tested in the specific setting after it was developed. This chapter describes the development of a hardware system step by step, followed by software development and execution.

4.1.1 TEMPERATURE SENSOR

- A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor or signal temperature changes.
- The working of a temperature meter depends upon the voltage across the diode .The temperature change is directly proportional to the diode's resistance.

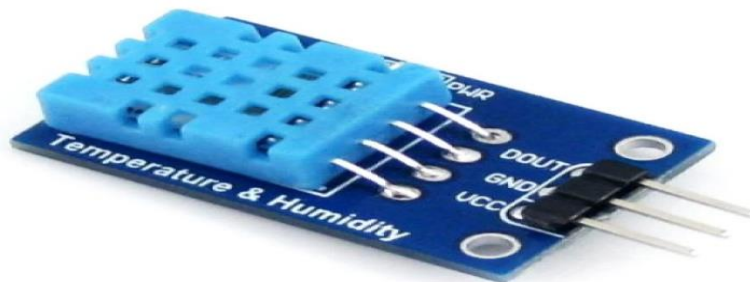


Fig: 4.1 Temperature & Humidity sensor

- HVAC/R systems, our digital temperature sensors help monitor industrial heating and cooling systems and control smart thermostats while thermocouples provide feedback to boiler controls in the home.
- In commercial aircraft, our NTC thermistors measure air and gas temperature, in a miniature and lightweight design that save space in small systems. In household stoves and appliances, our platinum temperature sensor can help amateur chefs prepare a meal perfectly and ensure they store it safely.
- In microwave ovens, our thermopile sensors can measure temperature without making contact with food. With TE temperature sensors, you gain the value of our deep experience in helping customers develop technology that can respond to the way people live.

4.1.2 HUMIDITY SENSOR

- Humidity sensors are electronic devices that measure and report the moisture and air Temperature of the surrounding environment where they are deployed e.g., in air, soil, or confined A spaces.
- Humidity measurements indicate the concentration of water vapour presented in the air. They provide their measurements in the form of a proper electronic signal. Moreover, they also report relative humidity i.e., the ratio of moisture in the air to the maximum moisture at a given temperature.
- Relative humidity is useful for many applications, like HVAC (Heating Ventilation Air Conditioning) and comfort optimization applications in Smart Buildings and Facilities Management. State of the art humidity sensors provide support for internet connectivity and can be flexibly deployed in the Internet of Things (IoT) applications. This facilitates the integration of humidity measurements with the output of other sensors (e.g., temperature sensors) and boosts IoT applications intelligence in various industry applications.
- The quality of a humidity sensor is reflected in its accuracy, reliability, response time, longevity, security, robustness, and ease of deployment. These

characteristics also determine the sensor's cost. Furthermore, they drive the selection of humidity sensors for different applications.

4.1.3 RAIN SENSOR

- Nowadays conserving water as well as its proper usage is essential in everyone's life. Here is a sensor namely rain sensor which is used to detect the rain and generate an alarm. so we can conserve water to use it later for different purpose.
- There are several methods available for conserving water like harvesting, etc. using this method we can increase the level of underground water. these sensors are mainly used in the field like automation, irrigation, automobiles, communication, etc.
- A rain sensor is one kind of switching device which is used to detect the rainfall. it works like a switch and the working principle of this sensor is whenever there is rain, the switch will be normally closed.

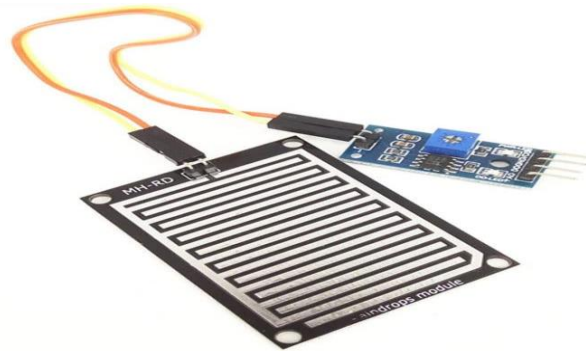


Fig: 4.2 Rain sensor

- Fig 4.2 shown as rain sensor board includes nickel coated lines and it works on the resistance principle. This sensor module permits to gauge moisture through analog output pins and it gives a digital output while moisture threshold surpasses.

- This module is similar to the LM393 IC because it includes the electronic module as well as a PCB. Here PCB is used to collect the raindrops. when the rain falls on the board then it creates a parallel resistance path to calculate through the operational amplifier

4.1.4 POLLUTION SENSOR

- The project is intended to provide the user with a cost-efficient means of determining air quality. The sensor focuses on the five components of the Environmental Protection Agency's Air Quality Index: ozone, particulate matter, carbon monoxide, sulphur dioxide, and nitrous oxide.
- The device also includes a town gas sensor to alert the user of gas leaks or the presence of flammable gases. Furthermore, a temperature and humidity sensor is included as these conditions can impact the performance of the gas sensors.
- It is important to create devices like this because excessive pollution such as CO₂ emissions is causing harm to the Earth. This device helps collect data about the air quality, so air quality issues can be resolved.



Fig :4.3 pollution sensor

- Fig 4.3 shown as the purpose of the project is to build an Air Pollution Detector that detects ozone, particulate matter, carbon monoxide, sulphur dioxide, and nitrous oxide levels. The project will student how to utilize IoT devices and Arduino devices to build useful devices.
- These sensors work on the principle of measuring the attenuation of infrared radiation radiation (of a specific wavelength) in the air.
- The sensors consist of an infrared radiation source (bulb), a light-water tube and an infrared detector with an appropriate filter. sensor is a device that

responds to some type of the input from the environment such as heat, light, motion, temperature, pressure and moisture. Sensors are used to switch currents and voltages. Every sensor has three terminals: Vcc, GND and output.

4.1.5 LDR SENSOR

- By sensing the radiant energy present in a relatively small range of frequencies often referred to as “light”, which runs in frequency from the infra-red to visible up to produces an output signal that indicates the intensity of light.
- The light sensor is a passive component that produces an electrical signal from this light energy. Whether it is in the visible or infrared portions of the spectrum. because they transform light energy into electricity, light sensors are more generally referred to as” photoelectric devices” or photo sensors
- LDR is used for detecting the presence of surrounding light.so that during the day time when sun is bright, the street light switched off. During the night time when there is no light, the LDR sends signal to micro controller to turn on the LED is glow.



Fig :4.4 Light Dependent Resistor

- Fig 4.4 shown as LDR or Light Dependent Resistor is also known as a photo conductor. As the name states it is a special type of resistor that works on the principle of photo conductivity. This means that the resistance changes

according to the intensity of light. Its resistance decreases with an increase in the intensity of light.

- In the dark, it has a very high resistance, sometimes up to 1 M ohm, but when the LDR sensor is exposed to light, the resistance drops drastically, to as low as a few ohms, depending on the light intensity. The sensitivity of LDRs varies with the wavelength of the light applied and are nonlinear device.

4.1.6 MICROCONTROLLER

- Microcontroller (MCU for micro controller unit, also MC, UC, or μ C) is a small computer on a single VLSI integrated circuit (IC) chip. A micro controller contains one or more CPU (processor cores) along with memory and programmable input/output peripherals.



Fig: 4.5 Microcontroller

- Fig 4.5 shown as the Program memory in the form of ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general-purpose applications consisting of various discrete chips.
- Microcontroller is a compressed microcomputer manufactured to control the function of embedded systems in office machines, robots, home appliances, motor vehicles, and a number of other gadgets. A microcontroller is comprising

components like - memory, peripherals and most importantly a processor. which was a 4-bit microcontroller with built-in ROM and RAM.

- The name '32-bit microcontroller' implies that the microcontroller is capable of handling arithmetic operation for a 32-bit value. Compared to an 8-bit microcontroller, the 32-bit microcontroller takes fewer instruction cycles to execute a function due to its wider data bus In 1971, the first microcontroller was invented by two engineers at Texas Instruments, according to the Smithsonian Institution.
- Core microcontroller components are CPU (Central Processing Unit), RAM (Random Access Memory) ROM (Read-Only Memory), Internal Oscillator (the main timer of the MCU) I/O (Input/Output) Ports, Peripheral Controller Chips (other optional accessories and components).

TABLE : 4.1 SPECIFICATIONS OF SENSORS

PARAMETERS	VALUE
Input Voltage	5V
Temperature Sensor	27
Humidity Sensor	87
Rain Sensor	4V
Pollution Sensor	38

4.2 IOT BASED SMART CITY MONITORING SYSTEM

Hardware results can be obtained by analyzing the input and output signals of various components of a hardware kit microcontroller (IEEE 1588) senses the data from the various sensors. According to LDR sensor output microcontroller turn on and turn off the relay. If relay is turned on DC Light will be glow.

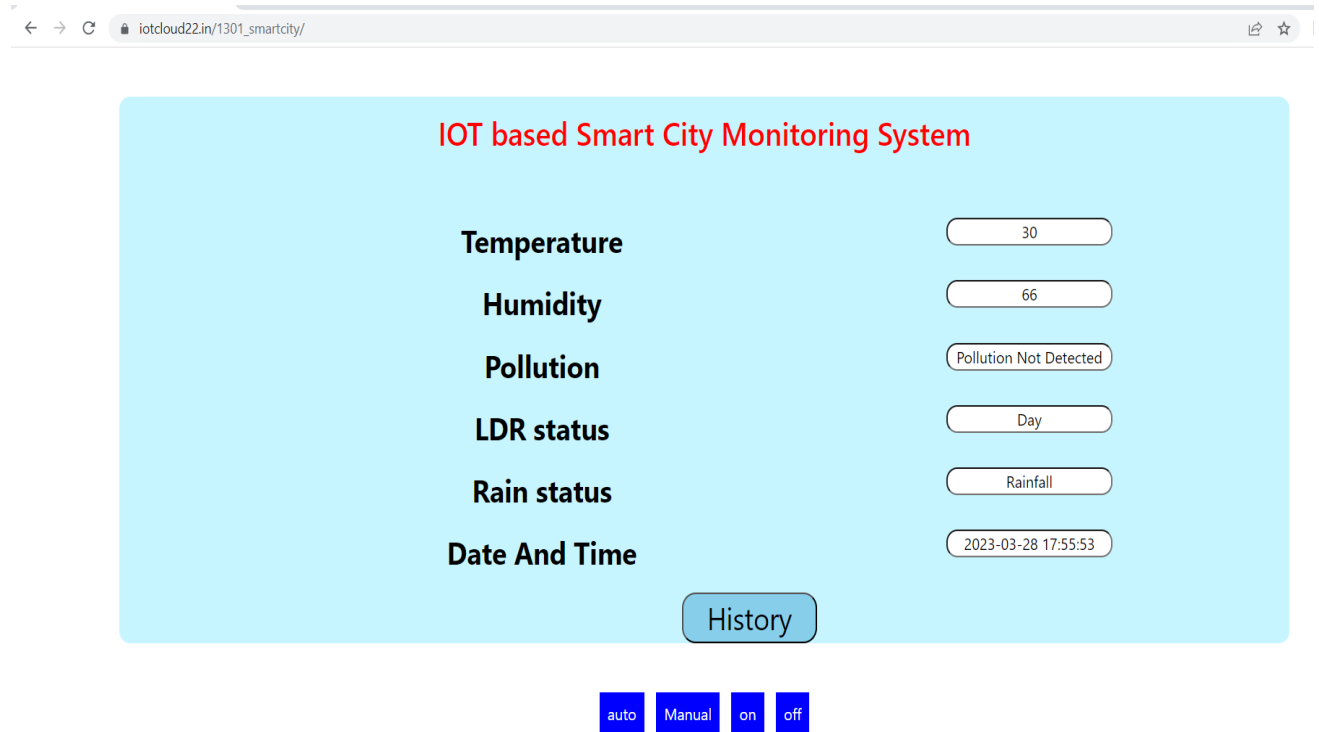


Fig :4.7 smart cities web page

Fig 4.7 shown as Air pollution, Street light, Natural disaster management, Safer communication can be monitored easily. Where ever we go we can able to monitor these data from there itself. If relay is turned off DC Light will not be glow. Temperature sensors, Rain sensor, Humidity sensor, Pollution sensor(528-2019-

IEEE) data are stored into cloud through Wi-Fi (IEEE 802.15.4). These data are monitored using our personal computer.

IOT based smart city Monitoring system

S.no	Temperature	Humidity	Pollution	LDR Status	Rain Status	Date And Time
1	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:35
2	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:30
3	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:26
4	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:24
5	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:20
6	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:16
7	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:14
8	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:09
9	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:07
10	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:04
11	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:56:00
12	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:55:56
13	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:55:53
14	30	66	Pollution Not Detected	Day	Rainfall	2023-03-28 17:55:48

Fig: 4.8 IoT based smart city monitoring system

Fig 4.8 shown as web page of IoT based smart city monitoring system. After collecting the data's will be stored at these websites, we will see the current situation or previously situation data in the cloud every time in everywhere.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 PROTEUS DESCRIPTION

The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB (Printed Circuit Board) layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller simulation. All PCB Design products include an auto router and basic mixed mode SPICE simulation capabilities. The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analogy and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control, temperature control and user interface design. It also finds use in the general hobbyist community and, since no hardware is required, is convenient to use as a training or teaching tool.

simulation we have used Arduino Software (IDE). Arduino IDE contains a text editor for writing code, a message area, a tool with buttons for common functions and a series. It connects to the Arduino and Genuine hardware to upload programs and communicate with them. Coded part is done in this software. We have to upload the code here and run. If there is no error in output the program will successfully given the positive result.

5.2 SIMULINK

We have to write Arduino program to monitor the serial port and receive the data and upload the program into the Arduino. Depending upon the data received we either turn off or turn on the LED. Then we setup a model in Simulink where we send either 1 or 0 using constant block via a manual switch block to serial send block. The serial send block is configured as COM2 port. Finally, we use the Virtual Serial Port Emulator (VSPE) program to pair COM1 and COM2 port and start the Proteus simulation then run the Simulink model. By switching the manual switch in Simulink, when 0 is sent the LED will be turned off in Proteus and when 1 is sent the LED is turned on. In this way we can interface and co-simulate Arduino and other circuit with Simulink. The next step is to start the simulation. First the Proteus simulation should start and then the Simulink model should be run. Then by changing the switch state to send 1 in Simulink model the LED connected to Arduino in Proteus is turned on. Similarly, when the switch state is 0 then the LED is turned off.

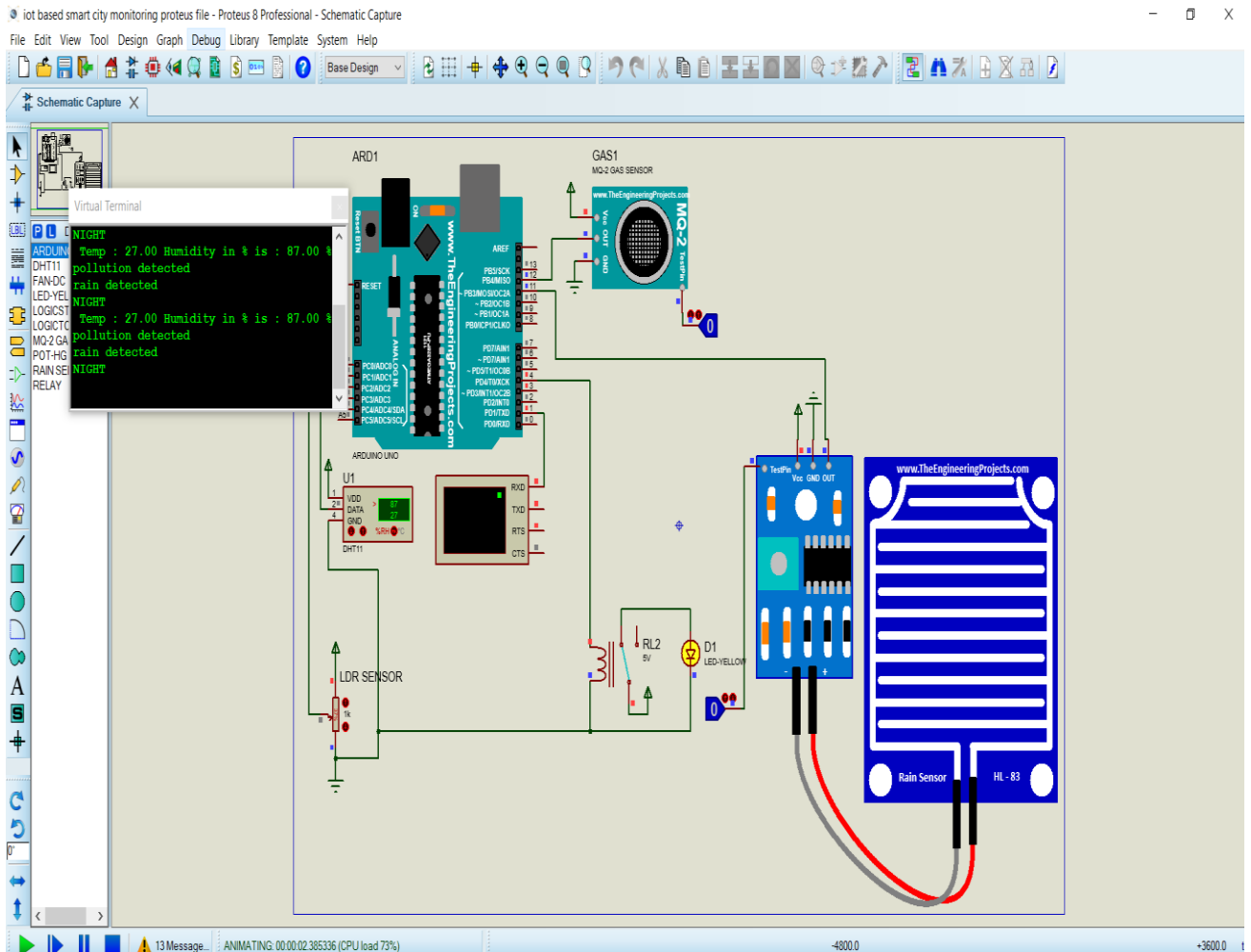


Fig :5.1 simulation of the project

Fig 5.1 shown as the simulation diagram shown as humidity sensor, temperature sensor, pollution sensor, rain sensor, LDR sensors connected to microcontroller. The microcontroller senses the signal and collected data will be stored in a cloud. Using relay, we are connected to the dc light.

5.3 HARDWARE RESULT:

In this hardware part we are using many sensors connected to the microcontroller. If temperature and humidity sensor senses the data and the display will show the temperature level and humidity level.

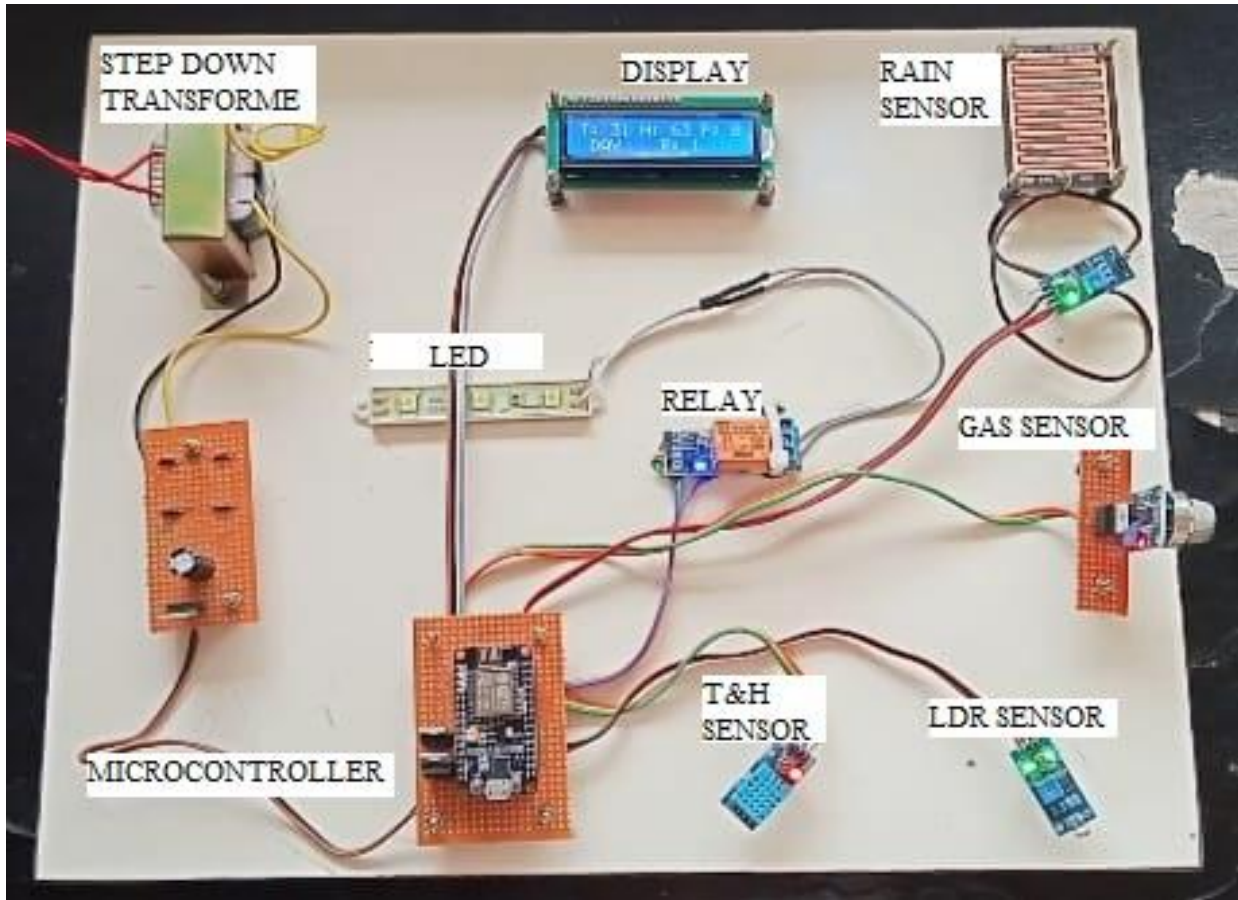


Fig :5.2 hardware results

Fig 5.2 hardware results shown as The humidity sensor are electronics devices that measure and report the moisture and air temperature of the surrounding environment where they are deployed e.g., in air ,soil ,or confined spaces.at the same way LDR sensor also, if its day or night these sensor will detect and shows the output in the display. Rain sensor prevent this frustrating and wasteful occurrence. These devices are designed to temporarily shut off an irrigation system so it stops running when it detects rain. gas sensor should be located near the floor for gases or vapour

three or four times heavier than air. All these are connected to the microcontroller and store it to the cloud.

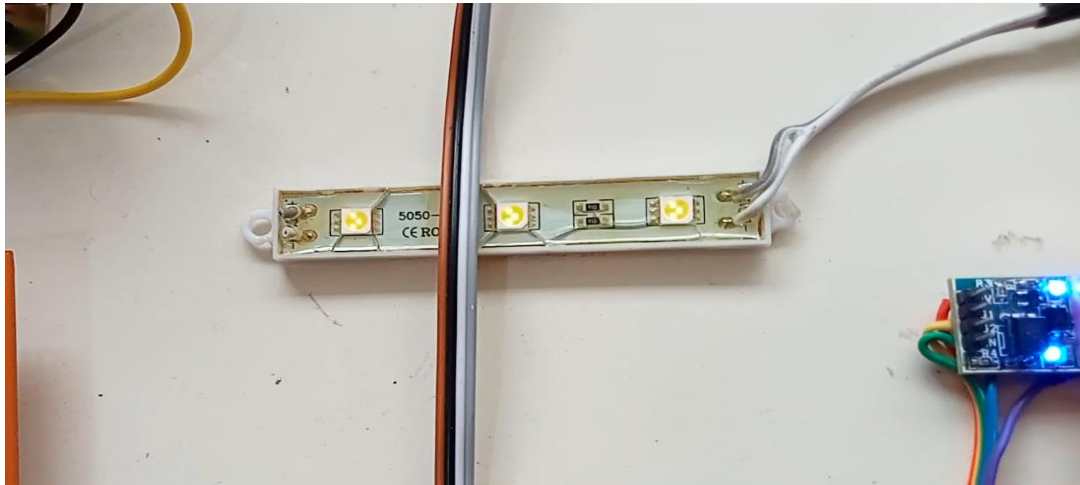


Fig: 5.3 LED glow

Fig 5:3 LED glow shown as hardware part we are using many sensors connected to the microcontroller. If temperature and humidity sensor senses the data's and the display will show the temperature level and humidity level. The humidity sensor are electronics devices that measure and report the moisture and air temperature of the surrounding environment where they are deployed e.g., in air, soil, or confined spaces. at the same way LDR sensors will identify whether it is day or night these sensor will detect and shows the output in the display.



Fig :5.4 LCD display

Fig 5.4 shown as the display of LCD it is analyses the data's of temperature humidity, pollution ,rain ,LDR by using the related sensors.

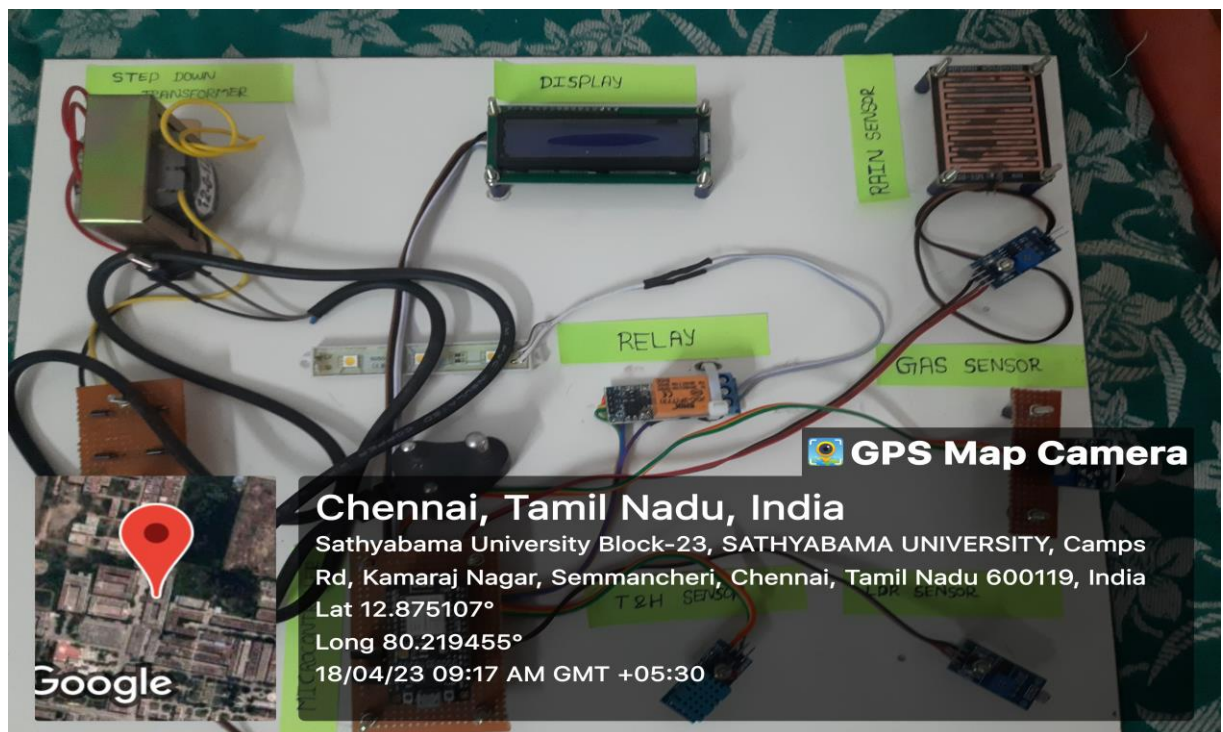


Fig:5.5 GEO tagged photo

CHAPTER 6

SUMMARY AND CONCLUSION

6.1 SUMMARY AND CONCLUSION

The scale of the market, the number of trials and experiments, and the demand for smarter cities' financial viability. Urban areas with rising populations must offer the infrastructure and services needed to suit the needs of both the city's people and those of the nearby residents, workers, and tourists. ICT is being utilized to create "smart cities," where citizens and the administration may access a range of real-time data about the urban environment to inform their plans, judgments, and deeds.

This project suggests a framework for creating "smart cities" that make use of the Internet of Things (IOT). With large-scale implementation, thoughtful deployment, and careful management, IoT, urban data platforms, big data, and artificial intelligence can transform our urban hubs into smart, sustainable, and efficient spaces smart city is a municipality that uses information and communication technologies (ICT) to increase operational efficiency, share information with the public and improve both the quality of government services and citizen welfare. Along with an exponential growth in connected devices, each thing in IoT communicates packets of data that require reliable connectivity, storage, and security. With IoT, an organization is challenged with managing, monitoring, and securing immense volumes of data and connections from dispersed devices. We propose a system that will capture all the details about the soil and the temperature by means of different sensors IOT permits objects to be sensed or controlled remotely across the network infrastructure. The result improves accuracy, economic benefits, efficiency and reduces intervention of human.

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APPENDIX

SOURCECODE

```
#include <DHT.h>    // including the library of DHT11 temperature and humidity
sensor

#define DHTPIN A0    // Selecting the pin at which we have connected DHT11
#define DHTTYPE DHT11
DHT dht ( DHTPIN, DHTTYPE ) ;
int humidity;
void setup() {
  Serial.begin(9600);
  dht.begin ( ) ;    // The sensor will start working
  pinMode(12,INPUT);
  pinMode(11,INPUT);
  pinMode(A1,INPUT);
  pinMode(3,OUTPUT);
  pinMode(4,OUTPUT);
}
void loop() {
  // put your main code here, to run repeatedly:
  float soil = analogRead(A0);
  int data1 = digitalRead(12);
  int data2 = digitalRead(11);
  int data3=analogRead(A1);
  float t = dht.readTemperature();
  float humidity = dht.readHumidity ( ) ;    // Declaring h a variable and storing the
humidity in it.
  Serial.print ( " Temp : " ) ;
  Serial.print ( t ) ;
  Serial.print ( " Humidity in % is : " ) ;
```

```

Serial.print ( humidity ) ;    // Printing the humidity on display
Serial.println ( " % \t " ) ;    // Printing "%" on display
if (data1==0) {
    Serial.println("gas detected");
    digitalWrite(3,HIGH);
}
else {
    Serial.println("gas not detected");
    digitalWrite(3,LOW);
}
if (data2==0) {
    Serial.println("rain detected");
}
else {
    Serial.println("rain not detected");
}
if (data3<500) {
    Serial.println("ldr detected");
    digitalWrite(4,HIGH);
}
else {
    Serial.println("ldr not detected");
    digitalWrite(4,LOW);
}
}

```