IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

Volume 11, Issue 6, June 2022

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.18

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE)

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

|DOI:10.15662/IJAREEIE.2022.1106031 |

IOT Based Monitoring and Controlling of Smart City Automation Using Edge Computing

Mrs. M.SUGANYA, M.E., RENGANATHAN R, SARAN T G , SRIRAM M,

Assistant Professor, Department of ECE, Gnanamani college of Technology, Namakkal, India

B.E Final year, Department of ECE, Gnanamani college of Technology, Namakkal, India

ABSTRACT: In today's world Smart Cities are being established and the core of smart city implementation is the Internet of Things (**IoT**). India is not far behind when it comes to building smart cities. Our country has already announced his vision of setting up over 100 smart cities across the country. A city "**connecting the physical infrastructure, the information-technology infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city**". Smart cities use IoT devices such as connected sensors, lights and meters to collect and analyze data. The cities then use this data to improve infrastructure, public utilities, services and more.

KEYWORDS: IOT, smart cities, Cloud computing, smart city information system, etc.

I. INTRODUCTION

Smart city applications tend to adopt IoT and edge computing broadly for distributed data collection, communication and processing. The smart city automation using Internet of Things controlled by connecting appliances to it and the appliances can be easily controlled remotely through internet. The designed system not only monitors the sensor data, like Temperature, Water Level, light and motion sensors but also Actuates process according to the requirement, for example switching on the light when it gets dark. It also stores the sensor parameters on a cloud (Server) in a timely manner. This will help the user to analyze the condition of various parameters at any time anywhere. However, front-end sensors and devices are usually not so capable as those computing units in huge data centers, and for this sake, in practice, engineers choose to compromise for limited capacity of embedded computing and limited memory. it utilizes IoT sensors, actuators and technology to connect components across the city, and it impacts every layer of a city, from underneath the streets, to the air that citizens are breathing.

Technically, everything is scalable; however, as power transfer rates go up, the complexity and size of the power management electronics must go up," he added. "More importantly, as the power goes up, a number of additional factors needs to be considered, such as thermal losses and thermal management. The higher the inefficiency, and the higher the power, the higher the heat losses and more that must be done to manage that heat."

Smart cities are composed of information and communication technologies (ICT) and the IoT to increase operational efficiency, improve both the quality of government services and citizen welfare, develop, deploy, and promote sustainable development practices to fulfill the ever-growing demands of citizens. Information and communication advancements empower better administration of accessible resources. Development of the technology has a major reason to bring ease and innovation into daily human life. Moreover, the re-search conducted over the emerging technologies also intends to bring efficiency to the present solutions. Increasing the efficiency of these technologies can make them eco-friendly, more productive, and agile.

The objective of the proposed system is to design a city with automated street lights which will be energy efficient and with smart garbage bins. To measure the air pollution, upload all the parameters measured to the cloud and also to analyze the stored data in order to provide better services to the citizen.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

|DOI:10.15662/IJAREEIE.2022.1106031 |

Smart cities are composed of information and communication technologies (ICT) and the IoT to increase operational efficiency, improve both the quality of government services and citizen welfare, develop, deploy, and promote sustainable development practices to fulfill the ever-growing demands of citizens. Information and communication advance-ments empower better administration of accessible resources. Development of the technology has a major reason to bring ease and innovation into daily human life. Moreover, the re-search conducted over the emerging technologies also intends to bring efficiency to the present solutions. Increasing the efficiency of these technologies can make them eco-friendly, more productive, and agile Smart cities are composed of information and communication technologies (ICT) and the IoT to increase operational efficiency, improve both the quality of government services and citizen welfare, develop, deploy, and promote sustainable development practices to fulfill the ever-growing demands of citizens. Information and communication advance- ments empower better administration of accessible resources. Development of the technology has a major reason to bring ease and innovation into daily human life. Moreover, the re-search conducted over the emerging technologies also intends to bring efficiency to the present solutions. Increasing the efficiency of these technologies can make them eco-friendly,more productive, and agile Smart cities are composed of information and communication technologies (ICT) and the IoT to increase operational efficiency, improve both the quality of government services and citizen welfare, develop, deploy, and promote sustainable development practices to fulfill the ever-growing demands of citizens. Information and communication advance- ments empower better administration of accessible resources.

Development of the technology has a major reason to bring ease and innovation into daily human life. Moreover, the re-search conducted over the emerging technologies also intends to bring efficiency to the present solutions. Increasing the efficiency of these technologies can make them eco-friendly, more productive, and agile Smart cities are composed of information and communication technologies (ICT) and the IoT to increase operational efficiency, improve both the quality of government services and citizen welfare, develop, deploy, and promote sustainable development practices to fulfill the ever-growing demands of citizens. Information and communication advance- ments empower better administration of accessible resources.

Development of the technology has a major reason to bring ease and innovation into daily human life. Moreover, the re-search conducted over the emerging technologies also intends to bring efficiency to the present solutions. Increasing the efficiency of these technologies can make them eco-friendly, more productive, and agile Smart cities are composed of information and communication technologies (ICT) and the IoT to increase operational efficiency, improve both the quality of government services and citizen welfare, develop, deploy, and promote sustainable development practices to fulfill the ever-growing demands of citizens. Information and communication advance-ments empower better administration of accessible resources.

Development of the technology has a major reason to bring ease and innovation into daily human life. Moreover, the re-search conducted over the emerging technologies also intends to bring efficiency to the present solutions. Increasing the efficiency of these technologies can make them eco-friendly, more productive, and agile Smart cities are composed of information and communication technologies (ICT) and the IoT to increase operational efficiency, improve both the quality of government services and citizen welfare, develop, deploy, and promote sustainable development practices to fulfill the ever-growing demands of citizens. Information and communication advance-ments empower better administration of accessible resources. Development of the technology has a major reason to bring ease and innovation into daily human life. Moreover, the re- search conducted over the emerging technologies also intends to bring efficiency to the present solutions. Increasing the efficiency of these technologies can make them eco-friendly, more productive, and agil

1.1 SMART CITY DESIGN: CHALLENGES AND OPPORTUNITIES

The challenges for building smart cities are quite diverse and complex; they include cost, efficiency, sustainability, communication, safety, and security. IOT comes with the combination of algorithms and computation, software & hardware that makes it smart. Ambient intelligence in IOT enhances its capabilities which facilitate the things to respond in an intelligent way to a particular situation and supports them in carrying out specific tasks. In spite of all the popularity of smart technologies, intelligence in IOT is only concerned as a means of interaction between devices, while user and device interaction are achieved by standard input methods and graphical user interface.

These design challenges are governed by various factors including the natural environment, government policy, social communities, and economy. Cost is the most important factor of smart city design. The cost includes design and operations costs. The design cost is a one-time cost. The operations cost is that required to maintain the smart city. Design cost needs to be small to make a smart city realization possible. At the same time, a small operations cost will make it easier for cities to operate in the long run with minimal burden on the city budget.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

|DOI:10.15662/IJAREEIE.2022.1106031 |

II. EXISTING SYSTEM

Bluetooth or Wi-Fi based automation system uses a PC or smart phone as receiver device. It has a limited range of 10 meters if the smart phone is out of range, then it will not be able to control the home appliances. And it won't work if you don't have proper internet connectivity.

For storing sensor data's Cloud storage is used in previous systems, when your data is getting transferred to the cloud the private information might get leaked from a cloud server. Most of the devices are monitored and controlled for the people. The Bluetooth system uses a PC or smart phone as receiver device. It has a high communication rate, great security and low cost, so it can be implemented as a real time system. Bluetooth network has limited range of 10 meters if the smartphone is out of range, then it will not be able to control the home appliances, this is one of the main disadvantages of Bluetooth based automation system. Through the internet of things, it is possible to control and monitor home appliances. With the internet of things, the physical world is becoming one big information systems. To enhance the living value of our life IoT technology is used to get novelty concepts.

III. PROPOSED SYSTEM

By automating and controlling following appliances, the electric power and human energy to be saved. These smart cities will promote the use of smart solutions to combat Energy wastage. Any combination of various smart components can make cities smart.

Speed and Web monitoring system: The radar system is installed at different locations in a city, which detects and measures the speed of vehicles. Different roads and regions have different predefined speed limits in their databases. If any vehicle crosses the speed limit or broken traffic rules of a particular region/road, the webcam monitor will be automatically activated and subsequently captures pictures of the vehicles responsible for it.

Temperature & Weather monitoring system (T&WMS): Measures the temperature of environment and parameters of weather like wind, UV index, pressure, etc. and display them for public information.

A common characteristics of existing approaches is that actions do not take place on time and negligence is way too more. Life could become more easy and flexible by implementing this technology in our daily lives. With the help of particular sensors particular faults or abnormalities could be detected and the corresponding status shall be sent to the authorized person who can assign his assistants to look after the issue.

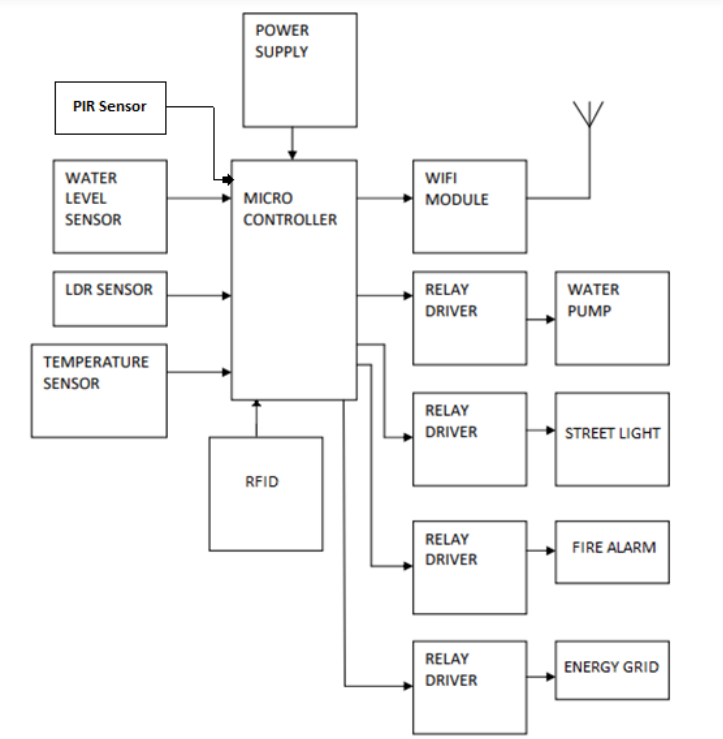
Fire detecting system (FDS): Detects fire accidents in a particular region and informs the region office as well as central control room. It also captures videos of accident to find the reason of fire accident and losses.

A city need not have all the components to be labeled as smart. The number of smart components depends on the cost and available technology. Such as Smart streetlights, Smart E-charge, Smart Thermostat, Smart Water Distribution System, Smart Building. Smart cities are composed of information and communication technologies (ICT) and the IoT to increase operational efficiency, improve both the quality of government services and citizen welfare, develop, deploy, and promote sustainable development practices to fulfill the ever-growing demands of citizens. Information and communication advance-ments empower better administration of accessible resources. Development of the technology has a major reason to bring ease and innovation into daily human life. Moreover, the research conducted over the emerging technologies also intends to bring efficiency to the present solutions. Increasing the efficiency of these technologies can make them eco-friendly, more productive, and agile

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

|DOI:10.15662/IJAREEIE.2022.1106031 |



1. Figure: Block diagram of automation

The sensor values and appliances status is received and analyzed by the raspberry-pi and, sent to cloud storage and user via Internet. This system will reduce the expansion cost; will add to the elasticity of advancement. Figure 1 shows the block diagram of our proposed method.

IV. SMART STREET LIGHT

IoT-based smart cities make maintenance and control of street lamps more straightforward and cost-effective. Equipping streetlights with sensors and connecting them to a cloud management solution helps to adapt lighting schedule to the lighting zone.

1.1 Figure: Automatic Street Light

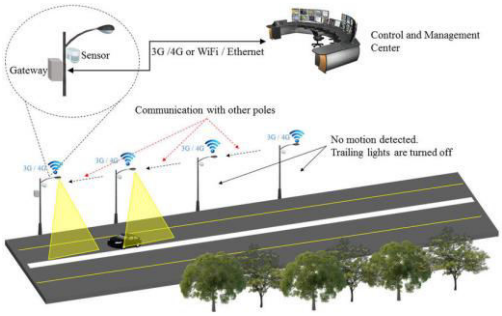
Smart lighting solutions gather data on luminance, movement of people and vehicles, and combine it with historical and contextual data (e.g., special events, public transport schedule, time of day and year, etc.) and analyze it to improve the lighting schedule. As a result, a smart lighting solution "tells" a streetlight to dim, brighten, switch on or switch off the lights based on the outer conditions.

For instance, when pedestrians cross the road, the lights around the crossings can switch to a brighter setting; when a bus is expected to arrive at a bus stop, the streetlights around it can be automatically set brighter than those further away, etc.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

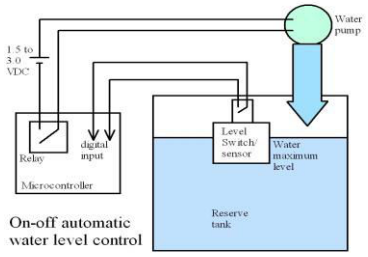
|DOI:10.15662/IJAREEIE.2022.1106031 |



An intelligent motion sensor street lighting control system that automatically activates when a car or pedestrian is noticed in the area. If there is no activity in the area, the light is automatically adjusted to an optimized minimum light level. Expansion of functionality options using the multifunction radar technology.

1. Smart Water Distribution Network

Smart water distribution network consists of (a) Water Storage points with water level and quality sensors along with water pumps, (b) distribution lines with pressure/flow sensors and electrically actuated valves, (c) Consumer points with flow meters.

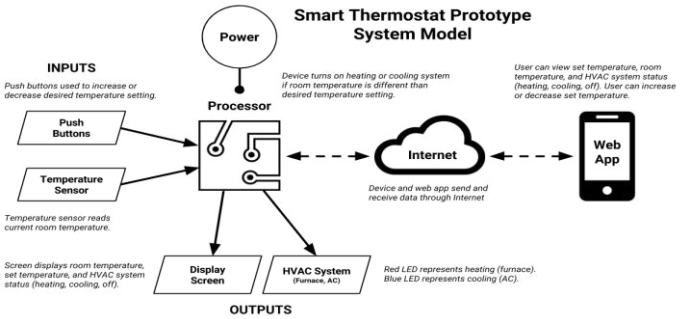


2. *Figure: Automatic Water level control*

The backbone of the smart water network is the water distribution network with electrically actuated valves that controls the flow of water to the households, area-wise and street-wise. At the pump side, the system monitors all the electrical parameters of the pump and also controls the pump speed (Variable Frequency Drive) taking the inputs from different control valves at every distribution level. The water level sensors will be designed to monitor the availability of water in the ground level storage points. The sensors and actuators data at every place in the water network are wirelessly communicated to the central server for the authority to view and take decisions.

V. SMART THERMOSTAT

The smart thermostat uses occupancy sensors to save energy by automatically turning off the HVAC when occupants are sleeping or away. The system uses cheap, simple motion and door sensors installed throughout the home. Based on these sensors, the system employs three energy saving techniques, as illustrated. First, the fast reaction algorithm uses a probabilistic model to process the sensor data and quickly estimate whether occupants are active, sleeping, or away.



| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

|DOI:10.15662/IJAREEIE.2022.1106031 |

This algorithm can typically respond within minutes of the occupants leaving the house, without introducing false vacancy detections. Second, the system combines historical occupancy patterns with on-line sensor data to decide whether to preheat the home or to heat after the occupants arrive. For experimental purpose LM35 basic temperature sensor is used. LM35 sensor detects room temperature. A flame sensor is used to detect where a gas valve is open and the fire is present. A humidity sensor or hygrometer senses, measures and reports both moisture and temperature. Finally, the system saves additional energy by allowing the temperature to drift further from the set point temperature when it is confident that the home is unoccupied. We call this a deep setback. These three techniques allow the system to automatically save energy without sacrificing occupant comfort.

Temperature and weather monitoring system (TWMS)

This system monitors the temperature and correspondingly the weather by the following sensors:

Temperature sensor: measures temperature through an electrical signal.

Atmospheric pressure sensor: a device that measures the atmospheric pressure. When air pressure increases, it indicates raise in barometer and decrease in air pressure indicates fall in barometer.

VI. SMART EV CHARGING

Smart EV charging or intelligent charging refers to a system where an electric vehicle and a charging device share a data connection, and the charging device shares a data connection with a charging operator. As opposed to traditional (or dumb) charging devices that aren't connected to the cloud, smart charging allows the charging station owner to monitor, manage, and restrict the use of their devices remotely to optimize energy consumption.

With cloud-based solutions, only sky is the limit (pun intended). Smart EV charging service can be modified: it is effortless to add and remove features and create a system that suits your needs. New features can also be added and updated to existing charging stations. This is why smart EV charging is also future-proof. Changing demands and hopes will be turned into new features, and added into the smart system as the world keeps changing. Electric cars connected to the grid with smart charging create a symbiosis with the power grid they support each other. Without smart charging, this connection wouldn't exist and EVs could become a burden on the grid.

Find available charging points easily on a mobile app and reserve your charging spot on the go. The mobile application shows you information about the charging power and price, and real-time data about the availability of charging stations

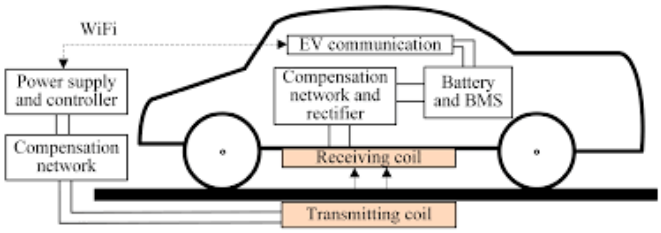


Figure: Smart EV Charging

Avoid unnecessary arguments and disputes on energy consumption between neighbours, as consumption data can be easily traced back to the right person. With smart charging, all EV drivers are billed after charging based on the station pricing. It all happens automatically: neither you as an EV driver or the charging point owner has to worry about payments. Automated billing is based on customer identification, thus the charging event only starts when you have successfully identified yourself at the station with the mobile app, RFID tags or the one-time payment service.

Smart charging events can be controlled based on various signals: for example, charging can be automatically set to start when electricity demand is at its lowest. The ability to control charging based on different energy production and consumption signals offers you new business opportunities. Energy management features should be provided for EV drivers as an opportunity, a chance to voluntarily take part in demand-response. Consumers also need incentives and information. Wireless charging can be done by three different modes, 1) static charging, 2) quasi- dynamic charging, and 3) dynamic charging . Compared to conductive power transfer, WPT is more convenient, electric shock protected and effective way to charge. The WPT is a system without any wires and transfers energy through the air gap. WPT is considered as a convenient method for charging EV. This paper is also covering various aspects of wireless charging of electric vehicles, fundamental operation of wireless charging system including inductive wireless charging technique.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

|DOI:10.15662/IJAREEIE.2022.1106031 |

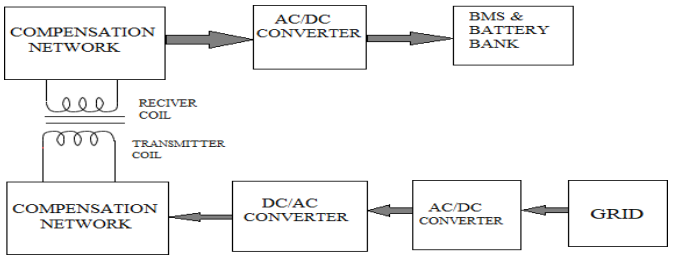


Fig. 4.1. Basic Diagram of Wireless Charging System for EV
Fundamental Operating Principle

The basic block diagram of the static WCS for EVs is shown in above Fig. Firstly, AC mains supply from grid is converted into high frequency AC using AC/DC and DC/AC converters, to enable power transfer from transmission coil to receiving coil. On both transmitting and receiving sides, include series and parallel combination-based compensation networks in order to improve system efficiency. High frequency AC goes to the transmitting coil which is mounted on ground or concrete through compensation network. The receiving coil, mounted underneath the vehicle, converts oscillating magnetic flux fields into high frequency AC then high frequency AC is converted to stable DC supply.

VII. IOT AS AN ENABLING TECHNOLOGY FOR SMART CITY

The IoT concept leverages several ubiquitous services to enable Smart City deployments all over the world. IoT introduces new Opportunities such as the capability to monitor and manage devices remotely, analyze and take actions based on the information received from various real-time traffic data streams. As a result, IoT products are changing cities by enhancing infrastructures, creating more effective and cost-efficient

Edge server: Uses all of the above classes, fetching images from the active devices, passing those images through the tracker, then sending data to Cloud IoT Core and providing the
data to the local web interface, municipal services, improving transportation services by decreasing road traffic congestion, and improving citizens' safety.

To achieve the full potential of IoT, smart city architects and providers recognize that cities must not offer a separate smart city feature, but rather deliver scalable and secure IoT solutions that include efficient IoT systems.

7.1 *IoT Applications for Smart Cities*

It is interesting to consider the application of the IoT paradigm to an urban context. Indeed, many national governments extensively are currently studying and planning how to adopt Information Communication Technology (ICT) solutions in the management of public services in order to realize Smart City concept, IoT smart city solutions can also provide citizens with utility management services. These services allow citizens to use their smart meters to track and control their usage remotely. For instance, a householder can turn off their home central heating using a mobile phone. Additionally, if a problem (e.g., a water leakage) occurs, utilities companies can notify householders and send specialists to fix it.

7.2 FEATURES OF IOT

7.2.1 OVERVIEW AND BENEFITS

The benefits of an established wireless remote switching system of home appliances include: No legal issues Obtaining access to or traversing properties with hard lines is extremely difficult.

7.2.2 Reduced wiring issues

Considering the increase in price of copper, thus increases the possibility of the wire to be stolen. The use of a wireless remote system to control home appliances means no wire for thieves to steal.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

|DOI:10.15662/IJAREEIE.2022.1106031 |

7.2.3 Extended range

As the system establishes control over Wi-Fi, it was a generally considered descent range. That is 150 feet indoors. Outdoors it can be extended to 300 feet, but since the application is of a HAS, an indoor range is considered.

7.2.4 Security

As the connection of the control of the HAS is established over a secure network the system ensures security to the maximum extent. 8 Efficient and Saves Time. The machine-to-machine interaction provides better efficiency, hence; accurate results can be obtained fast. This results in saving valuable time. Instead of repeating the same tasks every day, it enables people to do other creative jobs.

7.2.5 Saves Money

Optimum utilization of energy and resources can be achieved by adopting this technology and keeping the devices under surveillance. It can be alerted in case of possible bottlenecks, breakdowns and damages to the system. Hence, we can save money by using this technology.

7.2.6 Better Quality of Life

All the applications of this technology culminate in increased comfort, convenience, and better management, thereby improving the quality of life.

7.2.7 Integrable and extensive nature

The prototype designed can be integrated to a larger scale. Also it has an extensive nature being able to add or remove the appliances under control according to application. so higher management and even colleagues harass them by cracking obscene jokes, passing derogatory comment or trying to touch their private parts etc. In such cases, most of the women remain silent and try to ignore them in fear of losing job. Even some of them prefer to quit job as they believe lodging a complaint against the culprits will not help them anyway. In most of the cases the higher authority or management doesn‟t support the victim. Laws are there to protect working women against sexual harassment but only if complaints are lodged.

VIII. DESIGN SPECIFICATION

The temperature, humidity monitoring and controlling system must be sustainable in terms of economic, social and industrial needs. In order to improve the efficiency of the system as well as to meet the requirements of proposed solution, the design specifications of this project are set as follows:

- Measure the temperature and humidity of the environment all the time.
- Able to display the readings on the LCD.
- Implement IoT to the system.
- Acquired data can be uploaded to or retrieved from an online database.
- Display on the phone apps and record the previous history.

The temperature and humidity of the surrounding were measured using DHT11 which is specifically designed for these two measurements. Once the temperature and humidity are measured, the readings are displayed on the LCD for monitoring purposes.

IX. RESULTS AND DISCUSSIONS

The experimental model was made according to the circuit diagram and the results were as expected. The city appliances could be remotely switched over Wi-Fi network. Both the automation mode and the switch mode control methodologies were successfully achieved.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

|DOI:10.15662/IJAREEIE.2022.1106031 |

Production. It provides organic food, safe products and reduces cost of delivery. It helps in controlling water, environment and conservation of animal populations. It helps in smart waste management, recycling and reuse. It makes mobile payments easier and creates online ordering apps. It has delivered intelligent rail and other transit solutions. The asset tracking, smart roads, fleet management has become possible due to smart city solutions.

X. ADVANTAGES

- Less man power.
- WiFi and Ethernet based system.
- More accuracy in finding the fault location.
- Because of immediate action, less damage and losses.

XI. CONCLUSION

The "Smartness" of a city describes its ability to bring together all its resources. A smart city can have one or more smart components, including smart transportation, smart grid, smart health care, and smart governance. Smart cities with minimal implementation and operation cost are the keys for long term sustainability. The huge developments in the field of Information and communication technology in the climate change, mitigation, adoption and monitoring have added significant improvements to the traditional techniques in terms of accuracy, reliability, and faster data transfer. Consequently, these updated techniques reduce the overall system cost; provide real time observation, low power consumption, lively tracking, real time data processing and analysis. At the end of the day, having such improved national humidity and temperature monitoring system will positively affect people's livelihoods. There are several smart cities with some form of smart components operating at present at various parts of the globe. The need for smart cities is increasing day by day with the increase of population as earthly resources are limited. However, a proper internet connection is mandatory. Besides that, everything shall be at one's finger tips. Our project encourages "Make in India" and "Swachh Bharat" as well.

REFERENCES

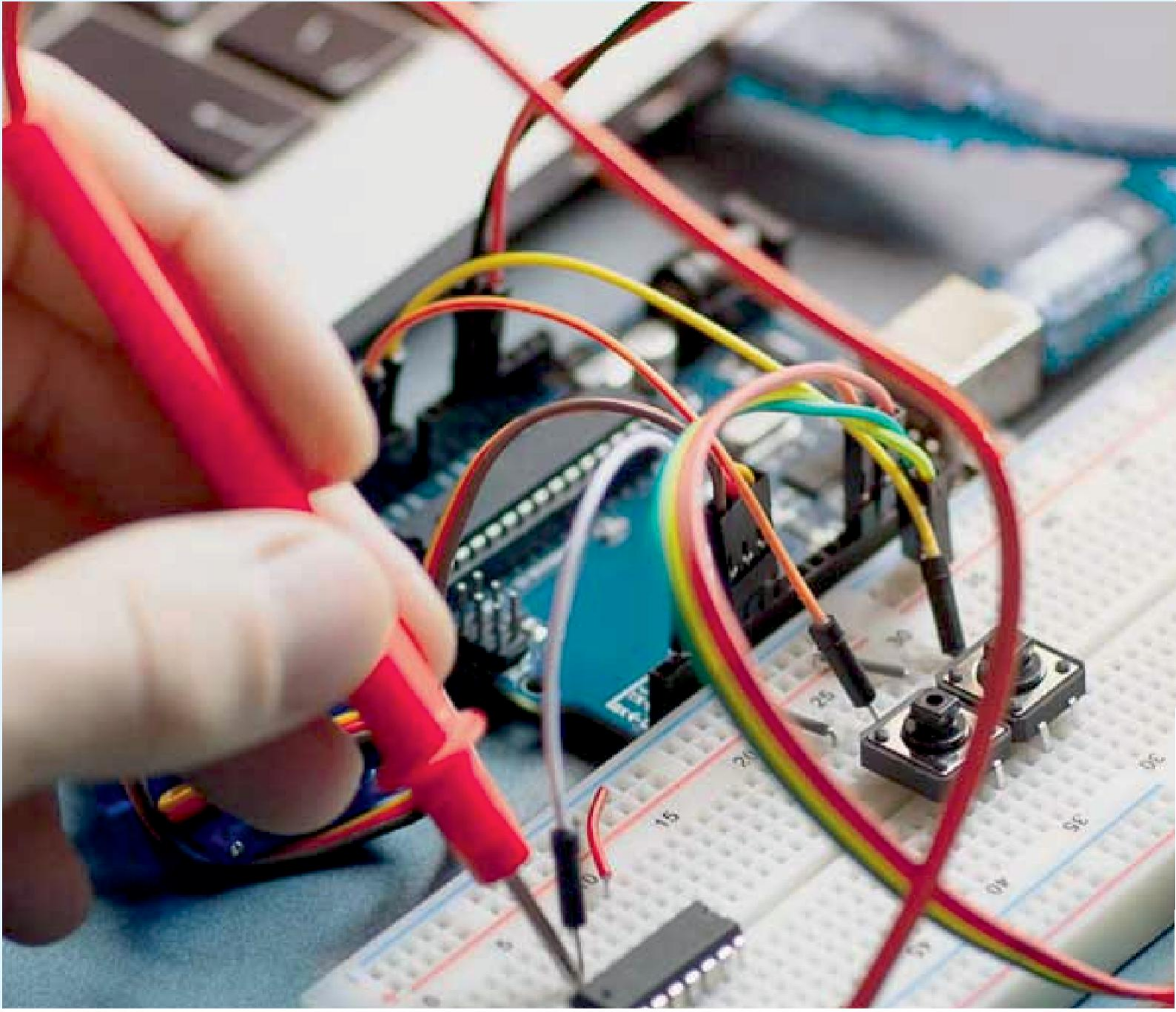
[1] Peng Su, Yuanyuan Chen, Mengmeng, " Smart City information processing under internet of things and cloud computing", Springer 2021
[2] Vishal, Dineshkumar, Soni, "Smart city design with IOT", Research Gate, 2019
[3] Arunkumar P, Vijith.K "IOT enabled smart charging stations for Electric vehicle" , Volume 119,2019.
[4] Giannakoulias A (2019) Cloud computing security: protecting cloud-based smart city applications[J]. J Smart Cities
[5] A.Ajithkumar, M.Ajithkumar, S.Gopi, V.G.Balajisabarinathan, "Smart E-Vehicle charging system using RFIF",IJRAR, SEP 2020.
[6] Onur Ayan, Belgin Turkay, "Smart Thermostats for Home Automation Systems and Energy Savings from Smart Thermostats", INSPEC Number: 18796952, IEEE Oct. 2018.
[7] Sathish PasikaSai TejaGandla ,"Smart water quality monitoring system with cost effective using IOT", Science direct Volume 6, Issue 7, July 2020.
[8] J. Pan, R. Jain, S. Paul, T. Vu, A. Saifullah, and M. Sha, An Internet of Things Framework for Smart Energy in Buildings: Designs, Prototype, and Experiments, IEEE Internet Things J., vol. 2, no. 6, pp. 527–537, 2015.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 6, June 2022||

|DOI:10.15662/IJAREEIE.2022.1106031 |

[9] Diponkar Kundu, Tushar Kumar Das, Smart Home Automation System Using on IoT", Research gate Volume 11, Issue 6, June-2020.
[10] T. Peltan, "Smart Cities as complexity management", in Proc. of the Smart Cities Symposium Prague (SCSP), 2019
[11] Things Boar. Things Board Open-source IoT Platform. https://thingsboard.io, 2017.
[12] Bestak R, Smys S, Big data analytics for smart cloud-fog based applications[J]. J Trends Comput Sci Smart Technol (TCSST)-2019.
[13] Yassine A, Singh S, Hossain MS et al, IoT big data analytics for smart homes with fog and cloud computing[J]. Future Gener Comput System -2019.
[14] Giannakoulias A, Cloud computing security: protecting cloud-based smart city applications[J]. J Smart Cities-2019
[15] Tang S, Shelden DR, Eastman CM et al, A review of building information modeling (BIM) and the internet of things (IoT) devices integration: present status and future trends[J]. Autom Constr-2019.
[16] Water Quality Monitoring and Waste Management using IOT were proposed by MANEESHA V RAMESH, NIB K V AMRITA CENTER for Wireless Networks and Applications (AMRITAWNA) in the year of 2018.
[17] Smart Water for Leakage Detection proposedby ELIASFARAH, ISAM SHAHROUR Laboratories de Genie Civil etgéo-Environnement (LGCGE) University de Lille 59650 Villeneuve d'Arcy, France in the year of 2018.
[18] S. Rajesh. Study and Control of DHT11 Using Atmega328P Microcontroller , International Journal of Scientific & Engineering Research. IJSER (2019): 10(4)
[19]] Texas Instruments, LM35 Precision Centigrade Temperature Sensors, http://www.ti.com/lit/ds/symlink/lm35.pdf, Accessed on November 15, 2019.
[20] Johnson, Khari. "A Global Smart-City Competition Highlights China's Rise in AI". Wired.Retrieved 7 January 2022.



INNO SPACE
SJIF Scientific Journal Impact Factor

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

Impact Factor: 8.18

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

9940 572 462 6381 907 438 ijareeie@gmail.com

www.ijareeie.com

Scan to save the contact details