A Minor Project Report
on

IOT BASED MANAGEMENT SYSTEM USING RENEWABLE ENERGY RESOURCES

Submitted by

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M.KUMARASAMY COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to Anna University, Chennai)
THALAVAPALAYAM, KARUR-639113.

MAY 2024

M.KUMARASAMY COLLEGE OF ENGINEERING

(Autonomous Institution, Affiliated to Anna University, Chennai)

BONAFIDE CERTIFICATE

Certified that this Report titled "**IOT BASED MANAGEMENT SYSTEM USING RENEWABLE ENERGY RESOURCES"** is the bonafide work of **ARIPRASATH T (927622BEE007), ENIYA S (927621BEE030), JANANI V (927622BEE044)** who carried out the work during the academic year (2023-2024) under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other project report.

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Submitted for Minor Project II (18EEP202L) viva-voce Examination held at M.Kumarasamy College of Engineering, Karur-639113 on ………………..

DECLARATION

We affirm that the Minor Project II report titled “**IOT BASED MANAGEMENT SYSTEM USING RENEWABLE ENERGY RESOURCES”** being submitted in partial fulfillment for the award of **Bachelor of Engineering in Electrical and Electronics Engineering** is the original work carried out by us.

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927622BEE044	JANANI V	------------------

VISION AND MISSION OF THE INSTITUTION

VISION

✓ To emerge as a leader among the top institutions in the field of technical education

MISSION

✓ Produce smart technocrats with empirical knowledge who can surmount the global Challenges.

✓ Create a diverse, fully engaged, learner - centric campus environment to provide Quality education to the students.

✓ Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To produce smart and dynamic professionals with profound theoretical and practical knowledge comparable with the best in the field.

MISSION

✓ Produce hi-tech professionals in the field of Electrical and Electronics Engineering by inculcating core knowledge.

✓ Produce highly competent professionals with thrust on research.

✓ Provide personalized training to the students for enriching their skills.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

✓ **PEO1:** Graduates will have flourishing career in the core areas of Electrical Engineering and also allied disciplines.

✓ **PEO2:** Graduates will pursue higher studies and succeed in academic/research careers

✓ **PEO3:** Graduates will be a successful entrepreneur in creating jobs related to Electrical and Electronics Engineering /allied disciplines.

✓ **PEO4:** Graduates will practice ethics and have habit of continuous learning for their success in the chosen career.

PROGRAMME OUTCOMES(POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree program, the students will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of solutions:

Design solutions for Complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

The following are the Program Specific Outcomes of Engineering Students:

- **PSO1:** Apply the basic concepts of mathematics and science to analyse and design circuits, controls, Electrical machines and drives to solve complex problems.
- **PSO2:** Apply relevant models, resources and emerging tools and techniques to provide solutions to power and energy related issues & challenges.
- **PSO3:** Design, Develop and implement methods and concepts to facilitate solutions for electrical and electronics engineering related real-world problems.

Abstract (Key Words)	Mapping of POs and PSOs
Solar panel, IoT, inverter, charge controller, etc	PO1,PO2,PO3,PO6,P07,PO9,PO10,PO11AND PSO1,PSO2,PSO3

ACKNOWLEDGEMENT

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We would like to thank our Head of the Department **Dr.J.Uma M.E., Ph.D,** Department of Electrical and Electronics Engineering, for their unwavering moral support throughout the evolution of the project.

We would like to express my deep gratitude to our Minor Project Guide **Dr.S.Sathishkumar M.E., Ph.D, Associate Professor.**, Department of Electrical and Electronics Engineering, for his constant encouragement, kind co-operation, valuable suggestions and support rendered in making our project a success.

We offer our whole hearted thanks to our Minor project coordinator **Mr.P.Maniraj M.E., Assistant Professor.,** Department of Electrical and Electronics Engineering, for his constant encouragement, kind co-operation and valuable suggestions for making our project a success.

We glad to thank all the Faculty Members of Department of Electrical and Electronics Engineering for extending a warm helping hand and valuable suggestions throughout the project.

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TABLE OF CONTENTS

ABSTRACT

The increasing global demand for sustainable and efficient energy solutions has led to the exploration and integration of renewable energy resources into various domains. In this context, this research presents an innovative Internet of Things (IoT)-based management system that leverages renewable energy sources for enhanced efficiency and sustainability. The proposed system integrates IoT technologies with renewable energy resources, creating a smart and adaptive infrastructure for effective energy management. Renewable energy sources such as solar and wind power are harnessed to meet the energy needs of the system, contributing to a cleaner and more sustainable energy ecosystem. The key components of this IoT-based management system include sensor networks, communication protocols, data analytics, and control algorithms. Microcontroller is a compressed microcomputer manufactured to control the functions of embedded systems in office machines, robots, home appliances, motor vehicles, and a number of other gadgets. A current transformer is a type of transformer that is used to reduce or multiply an alternating current. It produces a current in its secondary which is proportional to the current in its primary. Current transformers, along with voltage or potential transformers, are instrument transformers. Due to the nature of solar energy, two components are required to have a functional solar energy generator. These two components are a collector and a storage unit. The collector simply collects the radiation that falls on it and converts a fraction of it to other forms of energy (either electricity and heat or heat alone). The storage unit is required because of the non-constant nature of solar energy; at certain times only a very small amount of radiation will be received. At night or during heavy cloud over, for example, the amount of energy produced by the collector will be quite small. The storage unit can hold the excess energy produced during the 2 periods of maximum productivity, and release it when the productivity drops. Soil moisture detection is crucial for optimizing agricultural practices, conserving water resources, and ensuring plant health.

SURYEY FORM

Department of Electrical and Electronics Engineering

18EEP202L – Minor Project II

Problem Identification – Survey Form

1. **Name and Address of the community**:

2. Age Group

a) Less than 10 Years

b) 10 years to 20 Years

c) 21 years to 35 Years

d) 36 Years to 50 Years

e) More than 50 Years

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a) What? (Define the Problem)

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e) Who? (The person or thing that the problem affects)

f) How? (The sequence of events that resulted in the problem)

Signature of the respondent

g) Which? (People have attempted to solve the issue)

h) Does the problem appear to have only one possible solution?

4) Work Plan of the project

5) Final Solution

Signature of the surveyor


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CHAPTER 1
SURVEY FORM ANALYSIS
1.1 NAME AND ADDRESS OF THE COMMUNITY:

1. R. Dhanalakshmi,
   7/23 kanadian street,
   Pattukottai.
2. V. Rani, Elango nagar,
   Nadayanur (po), Karur.
3. V. Subburaj, IOB bank,
   Elango nagar, Karur.
4. D.Manikandan, 6/7, 8th street, Goundampalayam,
   Puliyur, Karur.
5. M. Pandiyan, 6/7, 9th street, Goundampalayam,
   Puliyur, Karur.

.

1.2 PROBLEM IDENTIFICATION:

As Mrs.V. Rani is over 44 years of age and she belongs to a middle-class family. Regular monitoring of plant moisture presents a significant challenge in both agricultural and horticultural contexts. This study addresses the complexities involved in consistently assessing plant moisture levels, which are critical for ensuring optimal plant health and maximizing crop yields. Traditional methods of moisture monitoring often labour-intensive, time consuming and prone to inaccuracies due to the environmental variations. Address challenges related to energy management, data transmission and device optimization. So she require an alternative methodology to solve her problems in her farm to sense the moisture and save electricity.

1.3 SOLUTION:

The solution is that the high cost of PV installations still forms an obstacle to this technology. Deploy soil moisture sensors powered by solar panels. Solar energy ensures that the sensors operate continuously without the need for the frequent battery replacements, making the system sustainable and cost effective. Integrate the sensors with IOT technology. Based on the analysed data ,the system can send alerts to farmers mobile device and automatically trigger the irrigation systems to maintain optimal healthy plant growth.

CHAPTER 2

LITERATURE REVIEW

Paper 1: Title- IOT ENABLED SOLAR POWER MONITORING SYSTEM, 2018,
Author- R.L.R. LOKESHBABU, D RAMBABU, A. RAJESH NAIDU

Inference: This article proposes a solution and method to monitor dust accumulated on solar panels to achieve maximum output economy. The output power of the solar panel always depends on the radiation directed to the solar cell. The system also shows lists of faulty solar panels and whether the electrical device is running directly on the solar panels or if the load is on the top battery. All panels are connected and sensors are connected directly to a central controller that monitors panels and loads. Incorporating IoT technology, data from panels and devices is sent to the cloud via the Internet also in future use, the remote user can monitor the parameters of the connected devices. Users can view current, previous and average parameters such as voltage, current, temperature, and sunlight using a graphical user interface. The controller is programmed with predefined conditions and the user is notified when it falls below the predefined conditions. Node MCU is used as a controller.

Paper 2: Title -SOLAR POWER MONITORING SYSTEM USING IOT, 2021
Author: NEHALIDATAR, SAKSHIBHOYAR, ASHAR KHAN, SAURABHDEKAPURWAR.

Inference: The power produced by solar panels must be effectively monitored and reduced production losses from solar power generation. We usually use solar power plants in construction in places where people don't go every day, so this approach helps them virtually manage your systems from remote locations. It controls the load using the panel IoT technologies and data from the panels are sent to the cloud for future use via the Internet. It also helps remote users observe the solar power plant. The user receives information about the current and previous average parameters such as voltage, temperature, and current. This way it is easier to notice the error and preventive sun care. In this article, we will use the Internet of Things (IoT) management and monitoring of solar energy (renewable energy).

This system is designed to solve problems such as management problems, maintenance, and others that arise in the production of solar electricity shortening the repair time. The cost of solar energy (renewable energy) using this technology, the generation will be smaller. It also provides real-time information to the user to facilitate the monitoring system. The main purpose of this article is that the solar panel can collect or retain maximum solar radiation and keep the system in order more reliably and efficiently.

Paper 3: Author: Suzdalenko, Alexander, and Ilya Galkin

Inference: Identify the problem of the non-intrusive load monitoring method of load disaggregation into separate appliances. When some local generators based on renewable energy sources are connected to the same grid, they may be mismatched with loads variable in time. Power by changing the load's apparent resistance and supplying the voltage during the nonlinear cases.

Paper 4: Author: Nkoloma, Mayamiko, Marco Zennaro, and Antoine Bagula

Inference: Are propose a novel monitoring, and control system for achieving real-time monitoring and control of a hybrid 'wind PV battery' for the renewable energy system. The proposed system constitutes a supervisory control and data acquisition (SCADA) system, which employs the campus network of National Cheng Kung University integrated with a programmable logic controller (PLC) and digital power meters. The proposed system is capable of performing real-time measurements of electrical data that can be effectively transferred to a remote monitoring center using the intranet.

Paper 5:: Inference Ersan KABALCI: Introduces tracking of a renewable power era machine that is constituted with solar panel arrays. In which he explained the implementation of the tracking gadget, the tracking device platform is primarily based on modern and voltage measurements of each renewable supply, and the related values are measured with a sensing circuit, and the coded visible interface of monitoring software can manage the saved facts to research the values of each size.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 BLOCK DIAGRAM:

The output of PV is essentially direct current (DC) form. Therefore, it needs to be converted to alternating current (AC) for it to be commercially feasible. This is necessary because the power utilization is mostly in AC form. This conversion can be done by using an inverter. In any PV-based system, the inverter is a critical component responsible for the control of electricity flow between the modules, battery, and loads.

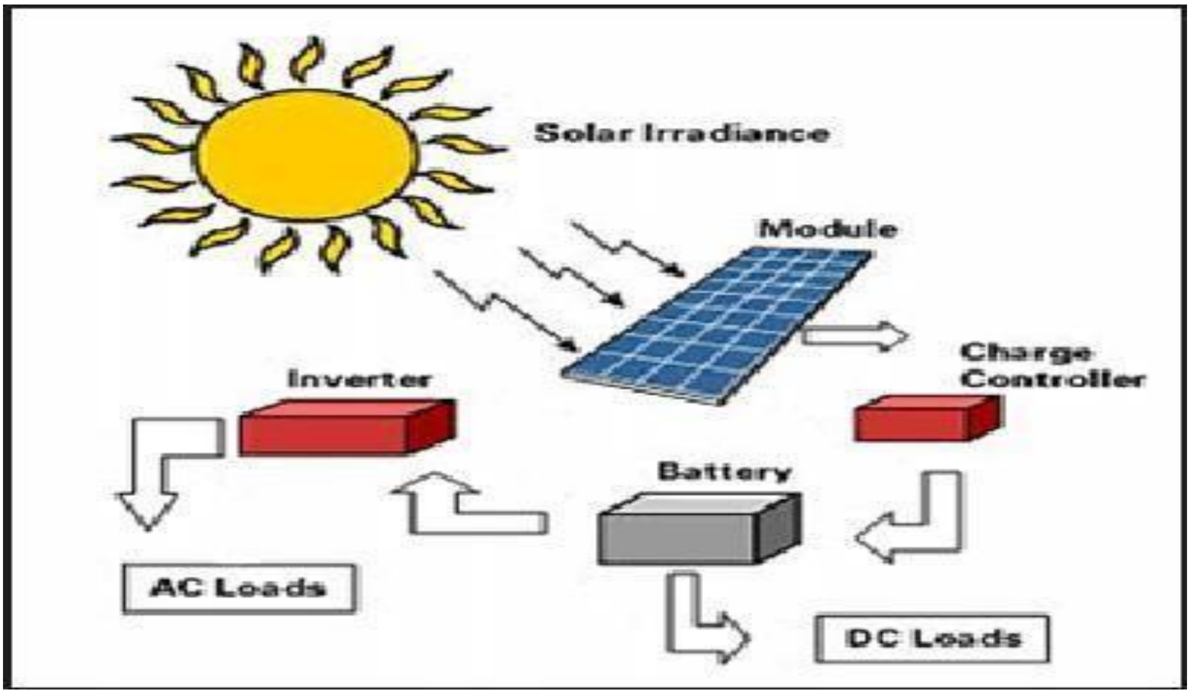

FIGURE 3.1 Iot based management system using renewable energy resources

Inverters are essentially DC-AC converters. It converts DC input into AC output. It can be designed to be used with different voltage ranges and topologies for varying applications. A solar inverter takes the DC electricity from the solar array and uses that to create AC electricity. Inverters are like the brains of the system.

- The proposed project describes that the solar energy is collected from the sun by using multiple solar panels through the MPPT (Maximum Power point Tracking) and the collected solar energy is stored in combiner box.

- The collected solar energy is fed as an input to the solar collector. The solar collector stores some of the energy in the battery. Here, in our proposed project we are using Multiple Batteries, which are called a battery bank.
- Some of the energy from the solar collector is fed to the inverter. So, the MOSFET switch is turned ON at the time of energy moving from the solar collector to the inverter.

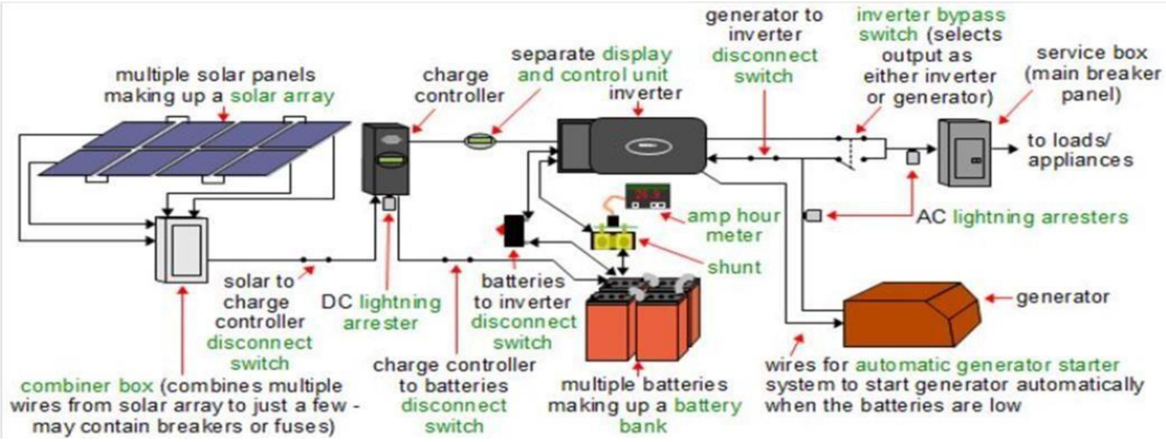

FIGURE 3.1 Iot based management system using renewable energy resources

- Whenever the switch turns ON and OFF the losses are calculated, which are called Switching Losses.
- For paralleling the battery, shunting applications are used in our project. Then, the DC is converted into AC to drive the load.
- The energy from the inverter is fed to the load and parallelly to the residential home appliances.
- It performs three modes of operation.
- Thus, compared with the existing project our project work is efficient in the order of values.

3.2 DESCRIPTION:

Renewable source energy requires rather sophisticated conversion techniques to make them usable to the end user. The output of PV is essentially direct current (DC) form. Therefore, it needs to be converted to alternating current (AC) for it to be commercially feasible. This is necessary because the power utilization is mostly in AC form. This conversion can be done by using an inverter. In any PV-based system, the inverter is a critical component responsible for the control of electricity flow between the modules, battery, and loads. Inverters are essentially DC-AC converters. It converts DC input into AC output. It can be designed to be used with different voltage ranges and topologies for varying applications A solar inverter takes the DC electricity from the solar array and uses that to create AC electricity. Inverters are like the brains of the system. Along with inverting DC to AC power, they also provide ground fault protection and system stats including voltage and current on AC and DC circuits, energy production, and maximum power point tracking. When sufficient output is available from Solar panels to charge the battery, solar panel charges a storage battery. At this time mains supply will not be utilized for charging purposes. A control circuit continuously monitors the battery's voltage. When the battery is fully charged, the circuit automatically turns on a power inverter and switches the appliance from running on grid power to running on the energy stored in the battery. Then when the battery's voltage drops too low, 15 the circuit automatically switches the appliance back to grid power until the battery is recharged. we can run the equipment like fans, LED lights, pumps, etc. directly without using the battery, but as the output of Solar panels is not steady due to clouds, bad weather, etc.

3.2.1 CONNECTION OF RENEWABLE ENERGY SYSTEM:

Step 1: Collect All the Components.

1. Solar panel
2. Combiner box
3. Charge controller
4. Inverter
5. Batteries
6. Amp-hour meter
7. Digital display
8. Switch

Step 2: Connect the Solar panel and combiner box.

- Connect the **Solar panel and combiner box** as shown in the diagram.

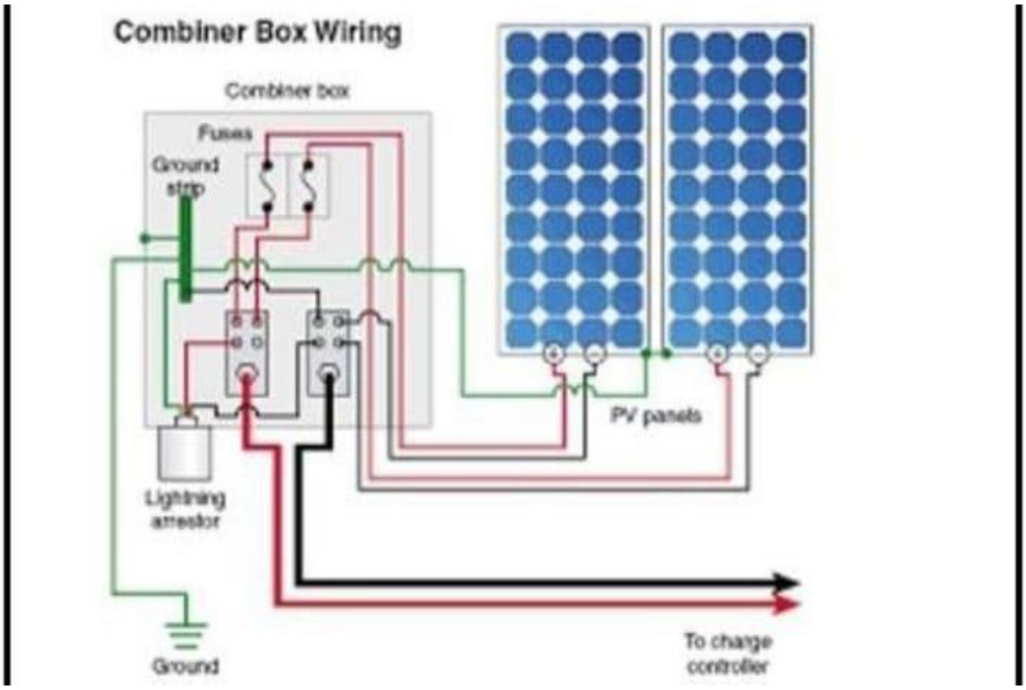

Figure 3.2.1 Solar panel to the combiner box

Step 3: Connect the combiner box to the inverter and to the battery.

A solar inverter, or PV inverter, converts the variable direct current (DC) output of a photovoltaic (PV) solar panel into a utility frequency alternating current (AC) that can be fed into a commercial electrical grid or used by a local, off-grid electrical network. It is a critical component in a photovoltaic system, allowing the use of ordinary commercial appliances. Solar inverters have special functions adapted for use with photovoltaic arrays, including maximum power point tracking and anti-islanding protection.

Step 4: Connect the Combiner box to the load.

Connect the combiner box to the load and the utility devices. The excess energy is stored in the batteries.

Step 5: Connect Other Parts. Connect the digital display, switch, amp-hour meter**.**

3.3.1. WORKING

An IoT-based renewable system consists of the following functions,

3.3.2. MODE 1:

- The charge controller stores the power in the battery and delivers the power to the load.
- At this time the battery gets charged.
- So, the excess power is produced in the solar.

3.3.3. MODE 2:

- The power in the MODE 2 operation, the solar power is fed to the charge controller.
- The charge controller delivers the power to the inverter to drive the load.
- At this time the battery doesn’t charge.

3.3.4. MODE 3:

- In MODE 3, the solar delivers power, but the load power is higher than the solar power.
- At this time the charge controller gets the power from the battery.
- Now, the battery gets discharged

PROJECT-TOTAL COST

S.NO	COMPONENT DESCRIPTION	QUANTITY	COST
01	SOLAR PANEL	2	1500
02	BATTERY	1	550
03	CHARGE CONTROLLER	1	1600
04	POWER SUPPLY	1	650
05	MICRO CONTROLLER	1	1050
06	INVERTER	1	700
07	OTHER EQUIPMENTS	1	100
		Total	6150

Table No: 3.3.5 Project -Total Cost

CHAPTER 4
RESULT AND DISCUSSION

4.1. HARDWARE COMPONENT DESCRIPTION:

SOLAR PANEL:

A 5v solar panel in a photovoltaic device that converts sunlight into electrical energy, typically used for small-scale such as charging batteries. The core of the solar panel consist of photovoltaic cells ,usually made of silicon. These are responsible for converting sunlight into electrical energy through the photovoltaic effect. In a 5V solar panel, the cells and circuits are configured to provide an output of 5 volts. This is suitable for charging USB devices, small batteries and other low-power electronics.

Figure 4.1 Solar panel

IOT'S:

Soil moisture sensor kits available for DIY enthusiastic and small-scale farmers, these kits include sensors, controllers and connectivity modules to set up a basic monitoring system.
To detect the soil moisture and environment data, integrating with farm management software.

Figure 4.2 IOT

BATTERY:

Batteries are used to store energy from solar panels are a critical component of electrical systems. Ensuring a reliable power supply even when the sun is not shining .

Figure 4.3 Battery

MOISTURE SENSOR:

The soil moisture sensor measures the water content in the soil. The sensor sends data to the IoT gateway. The gateway transmits the data to the cloud platform. The cloud platforms analyses the data and provides insight. Users access the data via a mobile or web dash board. The system can automatically activate if soil moisture falls below a set threshold.

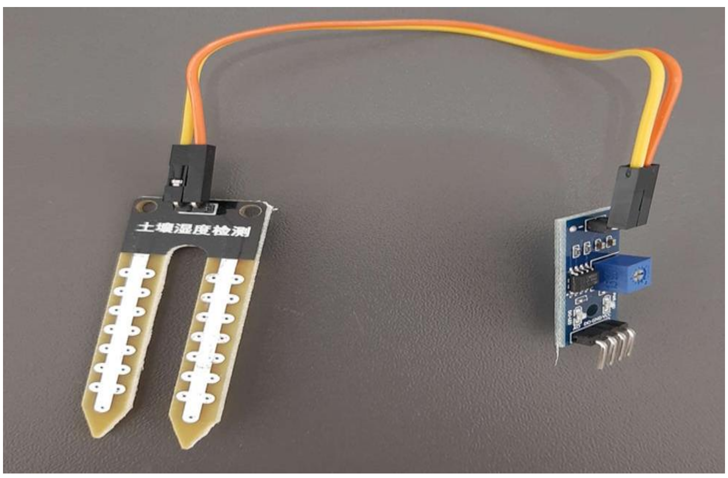

Figure 4.4 Moisture Sensor

4.5 HARDWARE KIT:

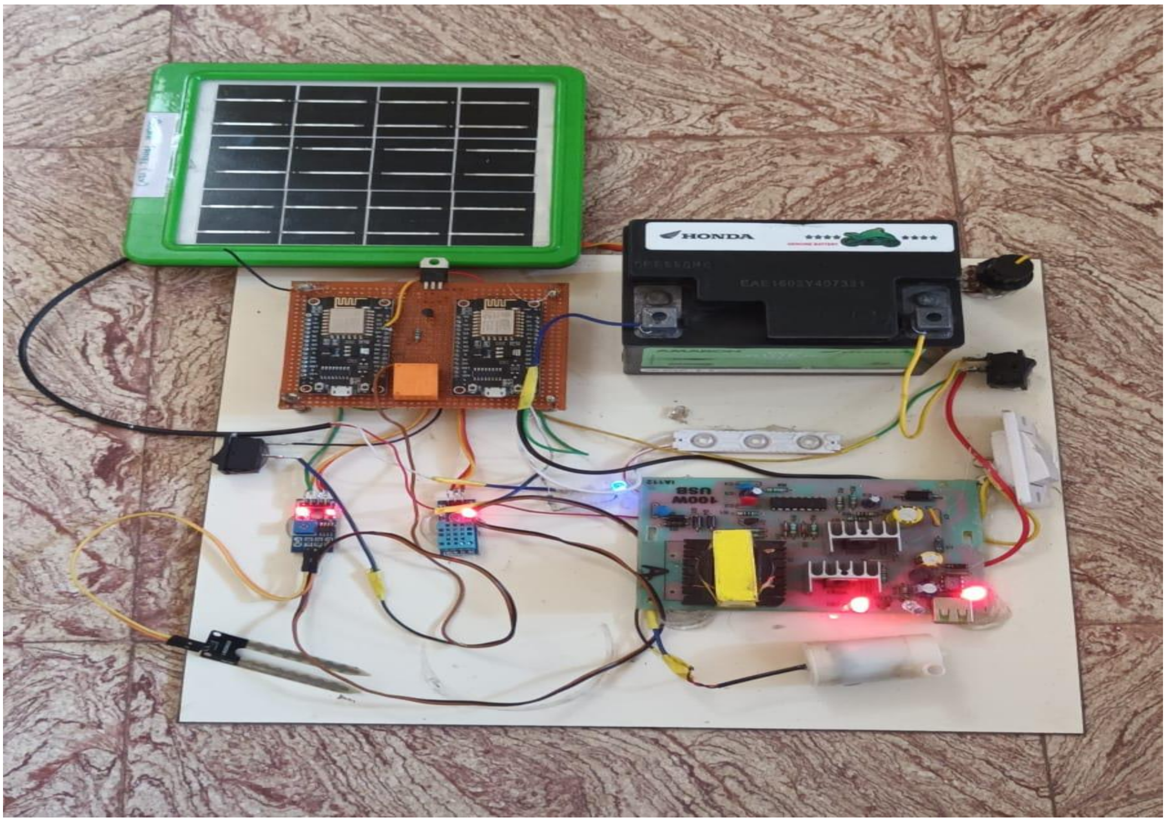

Figure 4.5 Hardware kit

4.6 WORKING PRINCIPLE:

The solar energy from the sun is stored in the solar panel. The energy collected from the sun is stored in the battery by using the DC to DC converter. To convert the DC supply into AC we use inverter. The stored power is given to the two IOT'S. By using the DHT 11 temperature humidity sensor and detection sensor we can sense the moisture. An app named BYLINK, through which we can see the notifications . From the solar IOT through which we can detect the voltage and current and power in the solar panel. And another IOT detects the moisture.

CHAPTER 5

CONCLUSION

The implementation of a IOT based management system using a renewable energy resource marks a significant step toward modernizing the agriculture. In conclusion, solar energy stands out as a highly promising and sustainable renewable system. Its abundant availability, environmental friendliness, and decreasing costs make it a key player in the transition toward a cleaner and more efficient energy landscape.

With continuous advancements in technology and growing global awareness of the need for sustainable energy solutions, solar power holds the potential to play a pivotal role in addressing both environmental concerns and energy security in the future. It is a crucial step towards building a more resilient and eco- friendly energy infrastructure. Based on the analysed data ,the system can send alerts to farmers mobile device and automatically trigger the irrigation systems to maintain optimal healthy plant growth.

POST IMPLEMENTATION SURVEY FORM

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PROJECT DEMONSTRATION VIDEO LINK:

https://drive.google.com/file/d/1Zn9AXn6MfX_I0C-SBsw2xU-kVMxWcean/view?usp=drivesdk

https://drive.google.com/file/d/1ZvcVCJDNreaA2omZk-YKB6h1NMxusWBt/view?usp=drivesdk

PROJECT IMPLEMENTATION- GEOTAG PHOTO:

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