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Fabrication of Rainwater Harvesting System using Solar Panel

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ABSTRACT: The fabrication of a rainwater harvesting system using solar panels involves the use of solar energy to power a water pump that draws rainwater from a collection tank and distributes it for various uses. The system comprises of a rooftop rainwater catchment system, gutters, downspouts, a filtration unit, a storage tank, a solar panel, and a water pump. The solar panel provides the energy required to power the pump, which in turn pumps the collected water through a series of filters to ensure its purity. The system is designed to reduce water wastage, promote sustainable water usage, and provide an alternative source of water for various domestic and agricultural purposes. The installation of such a system can be cost-effective in the long run, as it can help reduce water bills and the reliance on the public water supply.

KEYWORDS: Ground water, Rainwater Harvesting, Solar panels, Sustainability, Water scarcity, Water storage tank.

I. INTRODUCTION

The fabrication of a rainwater harvesting system using solar panels is a sustainable solution to address the global water scarcity problem. With the increase in population and urbanization, the demand for water is rising, and traditional sources of freshwater are becoming depleted. Moreover, the changing climate patterns have resulted in irregular rainfall and drought conditions in many regions. Rainwater harvesting is a technique that involves the collection, storage, and use of rainwater for various purposes. It is a simple and effective solution to address the water shortage issue, particularly in areas with low rainfall. In recent years, the integration of solar panels in rainwater harvesting systems has gained popularity due to the increased focus on renewable energy and sustainability. Solar panels can be used to power a water pump that draws water from a collection tank and distributes it for various domestic and agricultural purposes. The use of solar energy reduces the reliance on traditional sources of electricity and promotes sustainable water usage. Additionally, the installation of such systems can help reduce water bills and provide an alternative source of water for various applications. In this context, the fabrication of a rainwater harvesting system using solar panels can be a cost-effective and sustainable solution for addressing the water scarcity problem. The system can be designed to cater to the specific needs of a household, a community, or an agricultural operation.

II. LITERATURE SURVEY

This study provides an overview of solar-powered water harvesting systems, including design considerations, components, and operational aspects. The authors also discuss the potential benefits of such systems for sustainable agriculture.[1]

This article discusses the use of solar energy to extract water from the atmosphere using various techniques, such as dew condensation, fog collection, and air-to-water conversion. The authors review the current state of research in this area and highlight the potential for this technology in arid and semi-arid regions.[2]

This paper presents a new design for a solar-powered rainwater harvesting system that uses a solar-powered pump to extract water from a storage tank. The authors describe the system's performance and potential for use in rural areas with limited access to water.[3]

This study presents a detailed description of a solar powered water harvesting system that uses a solar-powered pump and a filtration system to extract and store rainwater.[4]

Rainwater harvesting for domestic applications: The case of Asunción, Paraguay. In this paper, we simulate

and analyze the impact of several variables on technical and economic performance indicators of RWH systems. An innovative point of this study is that we simultaneously use, as input to our simulations, rainfall data measured minute-by-minute and the monthly and diurnal patterns of water consumption. From the viewpoint of engineering application, using this enhanced level of detail, in comparison with other publications on RWH, is important for it allows a more accurate assessment of the RWH system's performance. No previous similar study has been done in the Greater Asunción region and the approach adopted here should be applicable and of interest to several other developing regions across the world, where rainfall is abundant but both the water supply and rainfall drainage networks are precarious.[5]

Solar power and heat production via photovoltaic thermal panels for district heating and industrial plant. The article compares several different scenarios for the particular case study in order to find the optimal solar system design. The scenarios differ with the size of the installed PVT area as well as an excess power utilization setup. The hourly load and solar energy generation alignment analysis determines the total achievable solar fraction and other parameters for each scenario. The results show that it is economically beneficial to convert excess power to heat when the market price of electricity is lower than the DH heat tariff. This is done with the restriction that the heat demand is higher than solar heat generated. The higher solar fraction is obtained in scenario of maximal PVT area (3000 m²) installation with a power accumulation added. Solar fraction reaches 38% of total heat and power consumption. However, this scenario also has the highest costs and incomes. The calculated value of levelized costs of energy (LCOE) for all scenarios is lower than used reference costs of energy.[6]

III. DESIGN OF MACHINE COMPONENTS

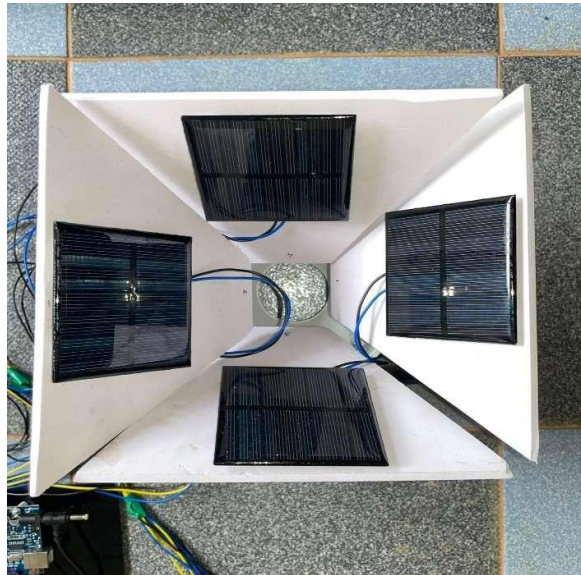
The components used in the design and fabrication of a rainwater harvesting system using solar panels should be selected based on their durability, efficiency, and suitability for the local climate and environmental conditions.

1. Arduino microcontroller: Arduino microcontroller is based on UNO AtMega328. It is used to receive commands sent by the user via the internet and processes according to the code and also used to control the motors.
2. Servomotor: A servomotor (or servo motor) is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity, and acceleration.
3. Rainwater sensor: The raindrop sensor measures the moisture via analog output pins and it provides a digital output when a threshold of moisture exceeds.
4. Printed circuits boards: Printed circuits boards are the circuit boards used in most electronic devices. The boards both physically and mechanically support the device alongside connecting the electronic components.
5. Step down AC: Step down AC adapter the step-down converters are used for converting the high voltage into low voltage. The converter with output voltage less than the input voltage is called as a step-down converter
6. Solar cell: Solar cell, or photovoltaic cell, is an electronic device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon.

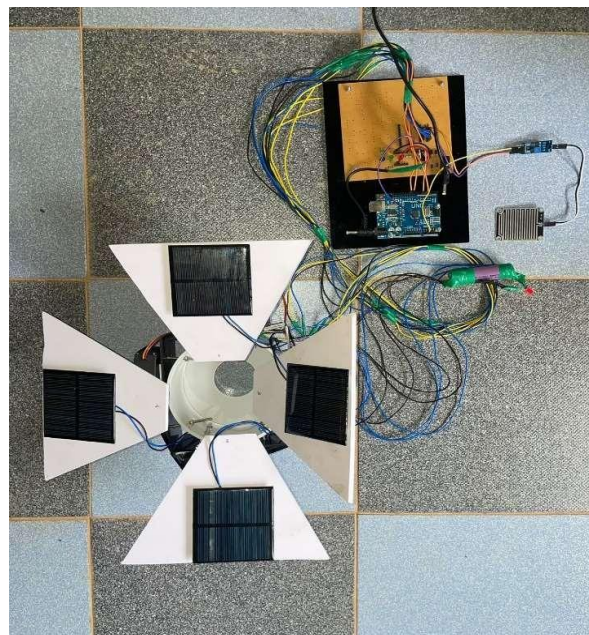


7. Battery: A battery is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices.

Model Diagram:



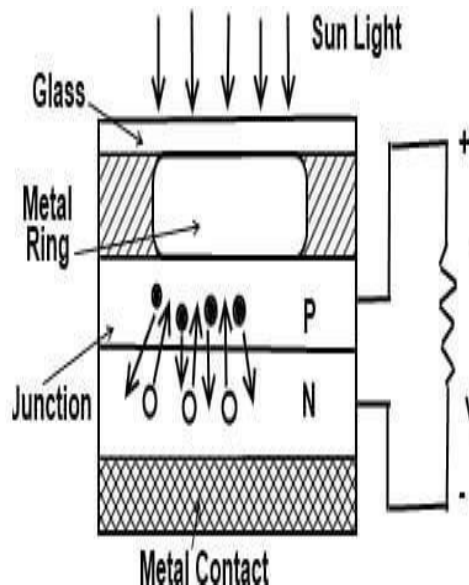
The model consists of 4 solar panels connect using links and gear for folding mechanism Four solar panel in the shape of a hologram or inverted pyramid will be used for the project. During Sunlight the solar panel will be used for collecting solar energy. A Rain Sensor will be used to detect the rain and then the four solar panel will close in the shape of hologram. A Linear to rotational gear mechanism is used for opening and closing of the system. The closed system can collect the water and transfer into the reservoir



IV. METHODOLOGY

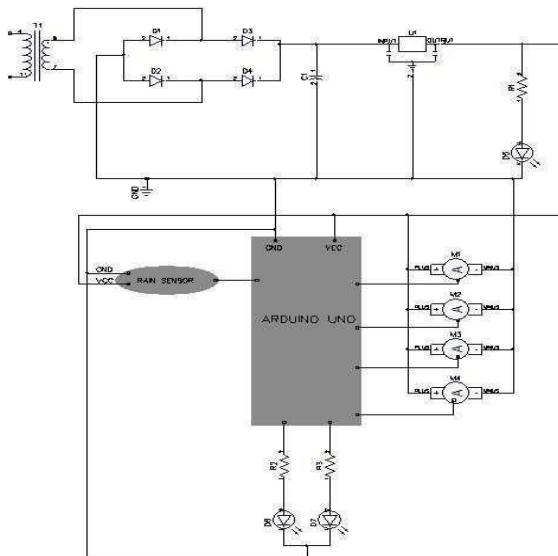
Four solar panel in the shape of a hologram will be used for the project. During Sunlight the solar panel will be used for collecting solar energy. The four panel is in $0^\circ, 25^\circ, 0^\circ$ and -25° angles with respect to ground. A Rain Sensor will be used to detect the rain and then the four solar panel will close at 45° in the shape of hologram. The closed system can collect the water and transfer into the water storage tank
Working principle of solar cell:

The working principle of a solar panel is based on the photoelectric effect. A solar panel is made up of multiple photovoltaic cells that convert sunlight into electrical energy. Each photovoltaic cell contains two layers of semiconductor material, typically silicon, with a thin layer of metal on top. When sunlight hits the cell, it excites the electrons in the semiconductor material, causing them to move towards the metal layer. This movement of electrons creates a flow of electricity, which can be harnessed to power devices or stored in batteries. The metal layer on top of the semiconductor material is designed to collect the electrons and channel them into an external circuit, such as a solar panel system. This external circuit can then use the electricity generated by the photovoltaic cells for various



applications, such as powering homes, charging electric vehicles, or running industrial equipment. The efficiency of a solar panel depends on several factors, including the quality of the semiconductor material, the design of the metal layer, and the angle and orientation of the panel towards the sun. Solar panels are most effective when they are placed in direct sunlight and angled towards the sun.

Circuit Diagram of The System:



V. CONCLUSION

This study has been tried to find a solution to the water scarcity caused by climate change by conducting regional studies with innovative adaptation technologies and systems. A new concept study was carried out by using a solar power plant with large surface areas in rainwater harvesting with a different approach. While ensuring the adaptation of the people of the region to a new situation such as water scarcity, a regional solution has been produced for the harvest, storage, and efficient use of wasted freshwater resources.

REFERENCES

- [1] Kaya, M. Evaluation of the existing solar energy and rainwater potential in the total roof area of buildings: Izmitdistrict example. *Advances in Materials Science and Engineering*, 2020, 8167402, 16 ps .
- [2] Kalç, M.Y., Abus, M.N. Rain water harvesting in a garden house sample. *International Journal of Agriculture and Wildlife Science (IJAWS)* 2018, 4(2), 209-215.
- [3] Pringle, A., Handler, R.M., Pearce, J.M. Aquavoltaics: Synergies for dual use of water area for solar photovoltaic electricity generation and aquaculture. *Renewable and Sustainable Energy Reviews* 2017, 80, 572-584.
- [4] Santra, P. Agri-voltaic system, Experiences with waterharvesting systems. 6th Indo-German Energy Conference 2019, 18th Sept. 2019.
- [5] O. I. Shittu, O. T. Okareh, and A. O. Coker, "Design and construction of rainwater harvesting system for domestic water supply in Ibadan, Nigeria," *Journal of Research in Environmental Science and Toxicology*, vol. 1, no. 6, pp. 153–160, 2012.
- [6] WaterAid, *Water Security Framework*, WaterAid, London, UK, 2012.
- [7] S. M. Shirazi, S. Akib, F. A. Salman, U. Johnson Alengaram, and M. Jameel, "Agro-ecological aspects of groundwater utilization: a case study," *Scientific Research and Essays*, vol. 5, no. 18, pp. 2786–2795, 2010.
- [8] B. Bates, Z. W. Kundzewicz, S. Wu, and J. Palutikof, *Climate Change and Water*, Intergovernmental Panel onClimate Change (IPCC), 2008.
- [9] S. Jain, P. Thakur, S. Singh, M. Srivastava, "Design of Rooftop Rainwater Harvesting Tank for Katpadi Region, Tamil Nadu", *SSRG International Journal of Civil Engineering (SSRG-IJCE)*, vol. 2, issue 7, Jul 2015, pp.68, ISSN: 2348 – 8352.
- [10] E. Eroksuz and A. Rahman, "Rainwater tanks in multiunit buildings: a case study for three Australian cities," *Resources, Conservation and Recycling*, vol. 54, no. 12, pp.1449–1452,



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