International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Solar Powered IOT Solution for Smart Farming and Soil Condition

Mr.U. Meri Kishore[1],K.S.Karthika[2], A.S.Fasiha[3], G.Pravallika[4], N.Venkata Kishore[5]
Associate Professor[1], UG Student[2, 3, 4, 5], Department of Electronics & Communication Engineering,
Sai Rajeswari Institute of Technology, Proddatur, Andra Pradesh,516360.
kishoreecepg@gmail.com[1], ksKarthika28@gmail.com[2],
shaikfasi95@gmail.com[3],pravallikaganjikunta@gmail.com[4],kvenkata313@gmail.com[5].

ABSTRACT

The integration of solar power and the Internet of Things (IoT) in agriculture has the potential to revolutionize traditional farming practices by improving efficiency, productivity, and sustainability. This paper presents a solar-powered IoT solution for smart farming, with a primary focus on real-time soil condition monitoring. The system consists of solar-powered IoT sensors deployed in agricultural fields to measure critical soil parameters, including moisture levels, temperature, pH, and nutrient content. These sensors are connected via a low-power wireless network to transmit data to a cloud-based platform. Farmers can access real-time data through a mobile or web application, allowing them to make informed decisions on irrigation, fertilization, and crop management.[3]

KEYWORDS-

Arduino Uno Micro controller, Solar power, LED display, battery, really, WiFi module,water pump.

I. INTRODUCTION

With The integration of solar-powered IoT (Internet of Things) solutions in smart farming is transforming agriculture by enhancing efficiency, sustainability, and productivity. By leveraging solar energy, IoT devices such as sensors and automated systems can monitor soil conditions, regulate irrigation, and optimize resource use without reliance on traditional power sources.These solutions provide real-time data on soil moisture, temperature, and nutrient levels, enabling farmers to make informed decisions that improve crop yields while conserving water and energy. With the combination of renewable energy and advanced technology, solar-powered IoT systems offer a sustainable approach to modern farming, addressing challenges like climate change, resource scarcity, and food security. Government is committed to advancing and developing the rustic levels that have set the stage for development, in all the provinces and territories of the Union. A lot of Smart City management should be conveyed to its residents and organizations in a powerful and effective way on stage alone. The combined efforts of organizations, for example, Governments, civil society organizations, of all shapes and sizes Companies, Farmers, Workers etc. need to fall on businesses to build a vibrant city. It serves as a watchdog for a community based organization with a high level of preparation and thinking at a low level of making people aware of new structures. Agriculture is an important source of individual work in our country. Over the past decade, it has been observed that there is not much product improvement in the agricultural business sector. Feeding costs are steadily increasing because the yield has dropped. It has forced more than 40 million people to live in poverty since 2010. It is extremely important to make successful mediation in the agricultural business and its design is included with Wireless sensor systems. [3]

II. PROBLEM STATEMENT

Maintaining Traditional farming methods often rely on manual monitoring and resource-intensive practices, leading to inefficiencies, water wastage, and suboptimal crop yields. In remote or off-grid agricultural areas, the lack of reliable electricity further limits the adoption of advanced farming technologies. Additionally, unpredictable climate conditions and soil degradation pose significant challenges to sustainable agriculture. Farmers need an efficient, cost-effective, and environmentally friendly solution to monitor soil conditions, optimize irrigation, and enhance productivity. The integration of solar-powered IoT solutions addresses these challenges by providing real-time soil data and automated control systems, ensuring efficient resource management and improved crop health. However, the widespread adoption of such technology faces barriers, including high initial costs, technological complexity, and the need for user-friendly implementation.

III. METHODOLOGY

The methodology for creating an Solar powered IOT solution for smart farming and soil condition defining the farming requirements, selecting the necessary hardware components, such as motors, sensors [2], and batteries, writing the software code using the Arduino IDE, assembling the components in accordance with the design, testing and debugging the system to ensure it satisfies the requirements, improving the design to add features, and documenting the design and code for later use. To produce a practical and effective tool that can carry out particular cleaning activities

automatically or manually, this requires a mix of hardware and software design and testing.

IV. BLOCK DIAGRAM

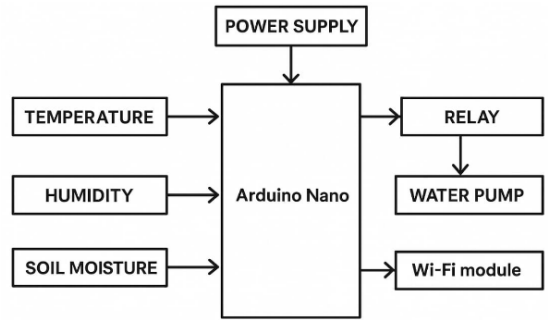


Fig: Block Diagram

V. COMPONENTS USED

1. ARDUINO UNO

The Arduino UNO is a widely used open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits The board features 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

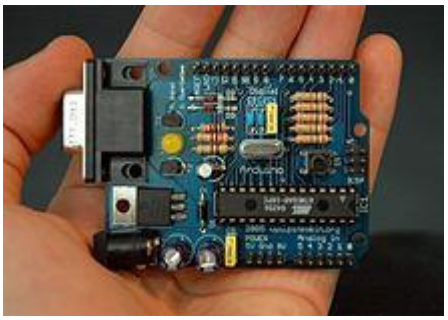
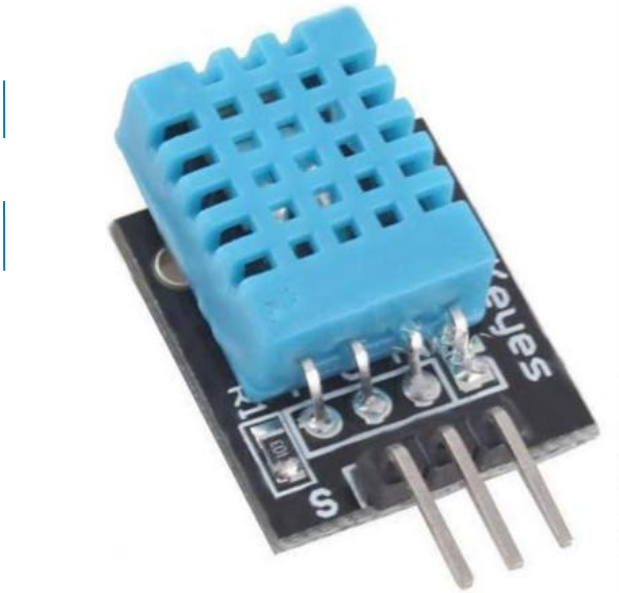


Fig: ARDUINO UNO

2. DHT Sensor

DHT sensors [2] are widely used in various applications due to their ability to measure temperature and humidity efficiently. DHT sensor is a digital temperature and humidity sensor commonly used in environmental monitoring and automation projects. It consists of a capacitive humidity sensor and a thermistor to measure temperature, providing output



through a single-wire digital interface.

Fig: DHT SENSOR

3. WIFI MODULE

A Wi-Fi module is a compact electronic component that enables wireless communication between devices and the internet or local networks. It is commonly used in IoT applications, smart devices, and embedded systems.

Popular modules like ESP8266 and ESP32 offer built-in Wi-Fi capabilities, allowing micro controllers to connect to networks and transmit data wireless.

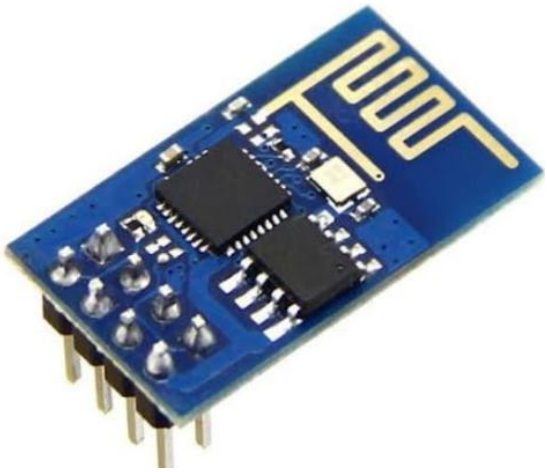


Fig: WIFI MODULE

4. SOIL MOISTURE SENSOR

A soil moisture sensor is a device used to measure the water content in the soil. It helps in determining the moisture level, which is crucial for agriculture, gardening,and environmental monitoring. These sensors work by detecting changes in electrical resistance, capacitance, or voltage, which vary based on the soil's moisture content. Farmers and gardeners use soil moisture sensors to optimize irrigation, preventing over watering or under watering, which can improve crop yields and conserve water.

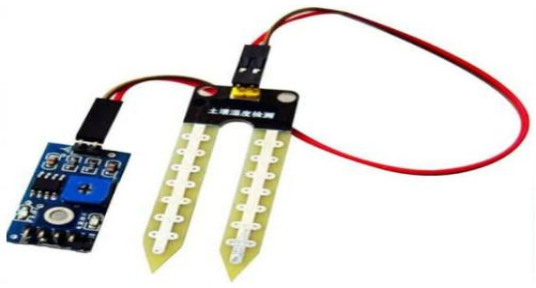


Fig: SOIL MOISTURE SENSOR

5. REALY

A relay sensor is an essential component in automation and control systems, serving as an interface between low-power control circuits and high-power devices. It operates by using a small electrical signal to switch a larger electrical load on or off. This functionality is crucial in various applications, such as industrial automation, home automation, automotive systems, and safety mechanisms. They enhance system efficiency, safety, and reliability by enabling remote control, isolation of circuits, and protection against voltage fluctuations.

Fig : REALY SENSOR

6. WATER PUMP

A water motor is a crucial device used for pumping and circulating water in various applications, including agriculture, households, and industries. It operates by converting electrical energy into mechanical energy, which drives an impeller or piston to move water through pipes. Water motors come in different types, such as centrifugal pumps, submersible pumps, and jet pumps, each designed for specific needs. They play a vital role in irrigation, water supply systems, and

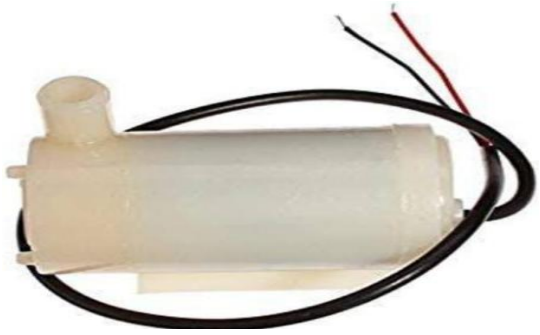
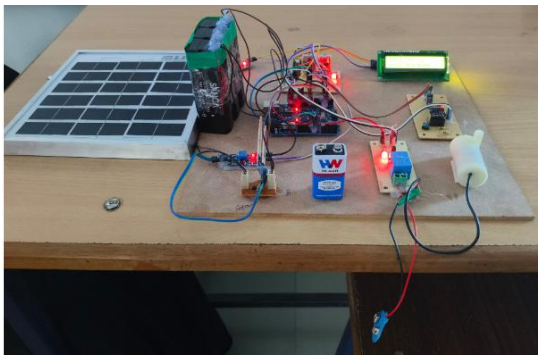


Fig: WATER PUMP

RESULT: -



CONCLUSION: -

The Solar powered IOT solution for smart farming and soil condition presented in this work successfully integrates renewable energy and advanced sensor technology to optimize agricultural practices. By utilizing solar panels, the system ensures uninterrupted power for IoT sensors that monitor essential soil and environmental parameters, such as moisture levels, temperature, pH, and nutrient content. These sensors transmit real-time data to a cloud-based platform via LoRa, NB-IoT, or Wi-Fi, enabling farmers to make informed decisions. Automated irrigation systems can be triggered based on moisture levels, reducing water wastage and improving crop health.temperature and humidity sensors help predict potential threats like drought stress or disease susceptibility, enabling proactive farm management. In conclusion, a solar-powered IoT system revolutionizes modern farming by providing data-driven, sustainable, and efficient agricultural solutions, ensuring healthier soil and better crop yields.

REFERENCES: -

[1] Managing Asian Cities: Sustainable and inclusive urban solutions, Asian Development Bank Report, Asian Development Bank, 2008, Publication Stock No. 050608, ISBN 978971-561-698-0, 2019.

[2] Viswanadham N., Vedula Sowmya,.Design of Smart Villages ,INDIA Moving up the Service Chain, 2019.

[3] TERI Draft Rajasthan State Action Plan on Climate Change New Delhi: The Energy and Resources Institute, 2019.

[4] O'Brien K., Leichenko R., Kelkar U., Venema H., Aandahl G., Tompkins H., Javed A., Bhadwal S., Barg S., Nygaard L., West J.. Mapping vulnerability to multiple stressors: climate change and globalization in India. Global Environmental Change 14(4): 303-313, 2019.

[5] FAO. Coping with climate change –the roles of genetic resources for food and agriculture, Rome, 2019.

[6] Maheswari.R, Sheeba Rani, Sharmila. P, Personalized Secured API for Application Developer', Springer Smart Innovations in Communication and Computational Sciences (Proceedings of ICSICCS-2018), pp. 401-411, 2019.