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HOME AUTOMATION SYSTEM

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Abstract : *A digital energy meter, also known as a smart meter, is an advanced device that accurately measures and records your electricity consumption in real-time. The proposed IoT-based energy monitoring system is a powerful tool for managing and monitoring energy consumption in homes and small businesses. It is designed to measure the voltage and power consumed by appliances connected to it, providing users with real-time energy consumption data and a historical record of energy usage over time. Additionally, the system is equipped with features that enable remote access via a software application, allowing users to monitor their energy consumption and track their daily usage patterns to identify opportunities for energy savings.*
Keywords - *Node MCU-ESP32, Relay Board, CT Current sensor, ZMPT Voltage sensor.*

I. INTRODUCTION

Smart energy meters are high-tech devices used in homes and businesses to track and manage energy consumption. Unlike traditional meters, these smart devices provide real time data to both the user and the utility provider, enabling more efficient energy usage. They can help identify when and where energy is being used most, and thus information can be used to reduce waste and cut costs. Plus, they can integrate with renewable energy sources and allow for easier and more accurate billing. Essentially, smart meters are a key tool in modernizing energy systems and promoting sustainable energy practices. They communicate directly with utility companies, allowing for quicker response times to outages and better overall grid management. For consumers, they offer detailed usage reports through online portals or apps, which can high light peak usage times and suggest ways to save energy. Some even come with home automation capabilities, letting you control smart appliances and Lighting systems remotely, contributing to a more energy-efficient household. With the development of precisely controlled, all solid state induction heating power supplies. Possible only after the discovery ofthe dynamo-electric principle and the availability of technically usable dynamo-machines inthesecond half of the nineteenth century. At that time, the development of induction melting started, followed later by the high- frequency heating of metallic bodies for hot-forming and heat-treating. An absence of powerful high frequency (HF) sources caused a big delay in the practical implementation of the initial ideas.

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PP 01-XX

II. Literature Survey

1. Name of paper: Home automation using Bluetooth Name of author: Ajaysinh Chauhan
Year of publication: 07 Jan 2012

Research into home automation systems covers the evolution of smart home technologies, focusing on frameworks like IoT, RF modules, Bluetooth, and cloud integration, which help make modern homes more user-friendly and accessible. The research discusses how home automation systems are designed for both convenience and energy efficiency, highlighting devices that enable remote control through smartphones and other interfaces, often using platforms like Arduino, Raspberry Pi, and various microcontrollers.

2. Name of paper: Home automation using IOT.
Name of author: Niyaz Sultan
Year of publication:11 nov 2018

This paper gives us the idea regarding the approximate calculations which has to be made in order to obtain the force exerted on a specimen and its power absorption in levitation melting. It also gives us the idea about the coil dimensions and the amount of currentrequired for the model to work.This paper the determination of the equilibrium shape of levitated molten metal in axisymmetric induction heating system is presented. The electromagnetic field is calculated using finite element method. For the equilibrium shape determination we use sensitivity analysis as a kind of optimization algorithm.

3. Name of paper: Home security.
Name of author: Gagnoud
Year of publication : 02 july2019

From this paper we got the advantages of the levitation melting of metals has some important advantages like cleanliness and superheating. In order to optimize this fusion process we present here a model of the coupled aspects of the magnetic field and of the equilibrium geometry of the liquid metal

4. Name of paper: Simulation designing for advance home technology
Name of author: Dewei .K.
Year of publication: 17 Feb 2019

This project demonstrates a simple home automation system that allows the user to control it with a wireless device such as a WI-FI or Bluetooth enabled mobile phone. A desktop PC is used to run the server software. The system allows the user to control each of the lights and fans individually. It can automatically turn off the main lights and turn on a night lamp at a specified time. By measuring the signal strength, it can detect when the user enters a room and automatically turn on the light and fans, and then automatically turn them off when the user leaves the room

5. Name of the paper: Iot based monitoring control system for home automation
Name of author: Raul Rabinovici
Year of publication: 19 August 2017

Home automation involves introducing a degree of computerized or automatic control to certain electrical and electronic systems in a building. These include lighting, temperature control, security systems, garage doors, etc. A hardware system is installed to monitor and control the various appliances. The system would control the appliances based on its configuration. For example, it could automatically turn on the lights at a specified time in the evening, or it could measure the ambient light using a hardware sensor and turn on the lights when it grows dark. It can also allow a person to control appliances from a remote location, such as over the internet. For example, one could turn on the air conditioning from the office, before leaving for home. This project demonstrates a simple home automation system that allows the user to control it with a wireless device such as a Wi-Fi or Bluetooth enabled mobile phone.

III. METHODOLOGY

Hardware Design
Component Selection:

- **ESP32-S3:** Selected for its dual connectivity features, ample GPIOs, and sufficient processing power.
- **SIM800 GSM Module:** Chosen for GSM communication to send data when Wi-Fi is not available.
- **OLED Display:** Selected for its low power consumption and clear visual output.
- **DHT11 Sensor:** Chosen for basic temperature and humidity sensing due to its low cost and ease of use.
- **Energy Monitoring Circuit:** Consists of current transformers and voltage dividers to measure electrical parameters.
- **EEPROM:** Used to ensure data persistence across power cycles.

Circuit Design:

- **Voltage and Current Sensors:** Connect to ESP32-S3's ADC (Analog-to-Digital Converter) pins for reading analog signals.
- **OLED Display:** Connected via I2C interface for efficient communication.
- **DHT11 Sensor:** Connected to a digital GPIO pin for temperature and humidity data.
- **SIM800 GSM Module:** Connected using serial communication (TX and RX pins) for data transmission.

Software Development
Development Platform: Arduino IDE.
Key Libraries:
- **WiFi.h:** Manages Wi-Fi connectivity.
- **TinyGSM:** Handles GSM communication.
- **Adafruit_SSD1306 & Adafruit_GFX:** Used for OLED display operations.
- **Firebase_ESP_Client:** Facilitates Firebase communication.
- **DHT:** Provides functions to read data from the DHT11 sensor.
- **EmonLib:** Library for energy monitoring and calculations.
- **EEPROM:** For storing and retrieving persistent data.

Firmware Implementation:

Initialization:

- Set up hardware components, initialize libraries, and configure Wi-Fi and GSM.
- Scan I2C bus to ensure OLED display is correctly connected.

Data Collectio*:

- Continuously read voltage, current, temperature, and humidity.
- Use EmonLib to calculate real-time power and energy consumption.

Data Processing:

- Calculate cumulative energy and cost.
- Periodically save energy data and cost to EEPROM.

Data Display:

- Use the OLED to toggle between different data metrics like voltage, current, power, energy, and cost.

Data Transmission:

- Connect to Firebase to upload data periodically.
- Ensure time stamping of data for historical analysis.

IV. Problem Statement

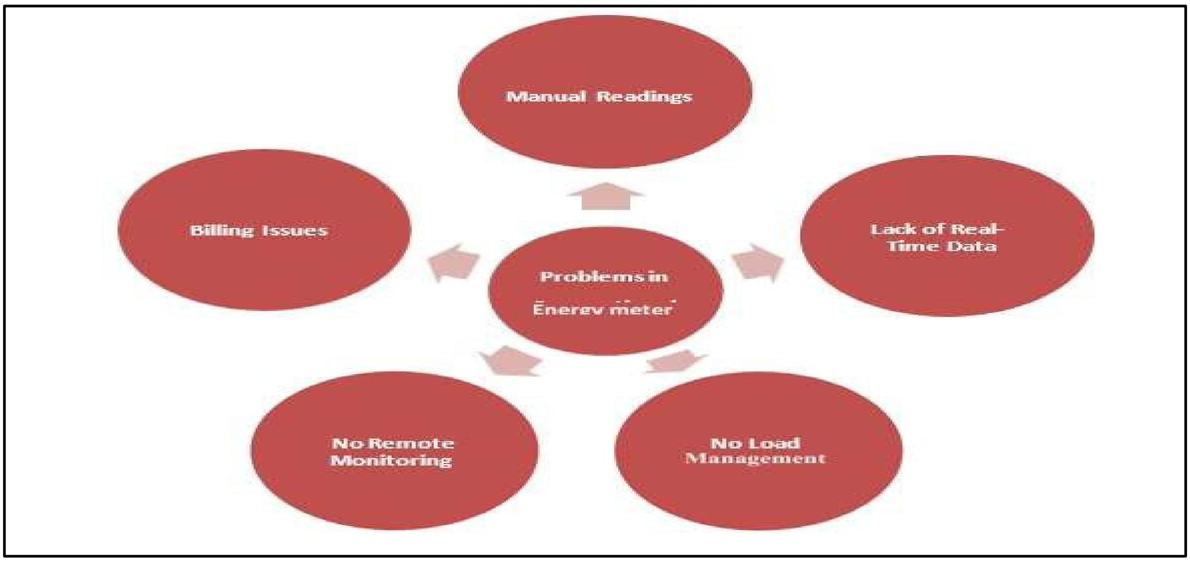

Fig1: Block Diagram of Floating Sun Tracker Hydraulic Solar Panel.

Manual Readings: They require someone to physically read the meter, leading to potential errors and the hassle of estimating readings.

Lack of real-time data: Users don't get immediate feedback on their energy usage, making it harder to adjust habits and save money.

Billing issues: Estimated readings can result in inaccurate billing, causing either overpayments or underpayments that need correction.

No load management: These meters don't provide insights into when and how much energy is used, so managing energy load is tough.

No remote monitoring: Utility companies can't monitor these meters remotely, leading to delays in identifying and issues.

V. FIGURES AND TABLES

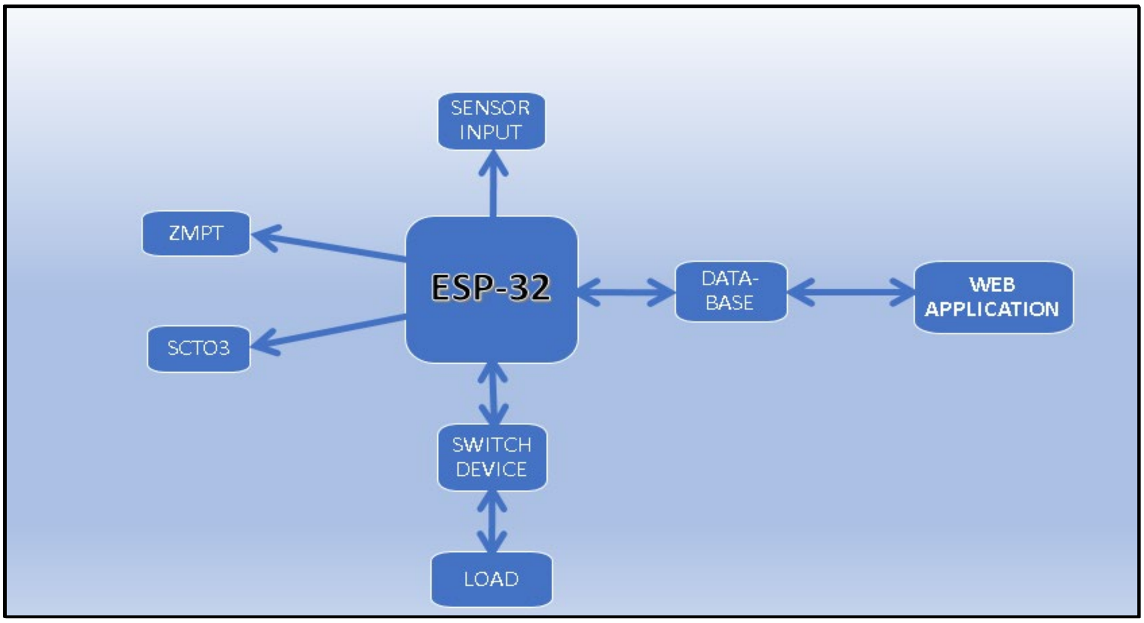

Fig 2: Block Diagram of Floating Sun Tracker Hydraulic Solar Panel.

Working Principle:

Power Monitoring:

- The system measures voltage and current using analog inputs.
- The EmonLib library calculates apparent power (product of voltage and current) and energy consumption (kWh).
- The energy consumption is accumulated over time and multiplied by a predefined cost per unit to calculate the total cost.

Data Storage and Display:

- Real-time measurements are shown on the OLED display, toggling between voltage/current/power and energy/cost every few seconds.

 Volume 1, Issue 8 (2025)
PP 01-XX

- The data is also saved periodically to EEPROM to maintain persistence across device restarts.

Connectivity:

- The device first attempts to connect to the internet using Wi-Fi.
- If Wi-Fi fails, it switches to the GSM module to use mobile data.
- This dual connectivity ensures that data can be transmitted regardless of the availability of Wi-Fi.

Data Upload to Firebase:

- The project uses Firebase Real-time Database to upload sensor readings, energy consumption, and cost data.
- If connected, it sends both real-time data and stores historical data.

Environmental Monitoring:

- The DHT11 sensor provides temperature and humidity readings, which are also displayed and uploaded to Firebase.

Error Handling and Reconnection:

- The system continuously monitors the connection status.
- If the GSM or Wi-Fi connection is lost, it attempts to reconnect.
- Firebase connectivity is also monitored and re-established if lost.

User Interaction:

- Users can view the current energy consumption and environmental conditions directly on the OLED display.
- Data can also be accessed remotely via the Firebase Realtime Database, allowing users to monitor energy usage from anywhere.
- This project is designed for remote energy monitoring in locations with unreliable Wi-Fi, using GSM as a fallback for reliable data transmission

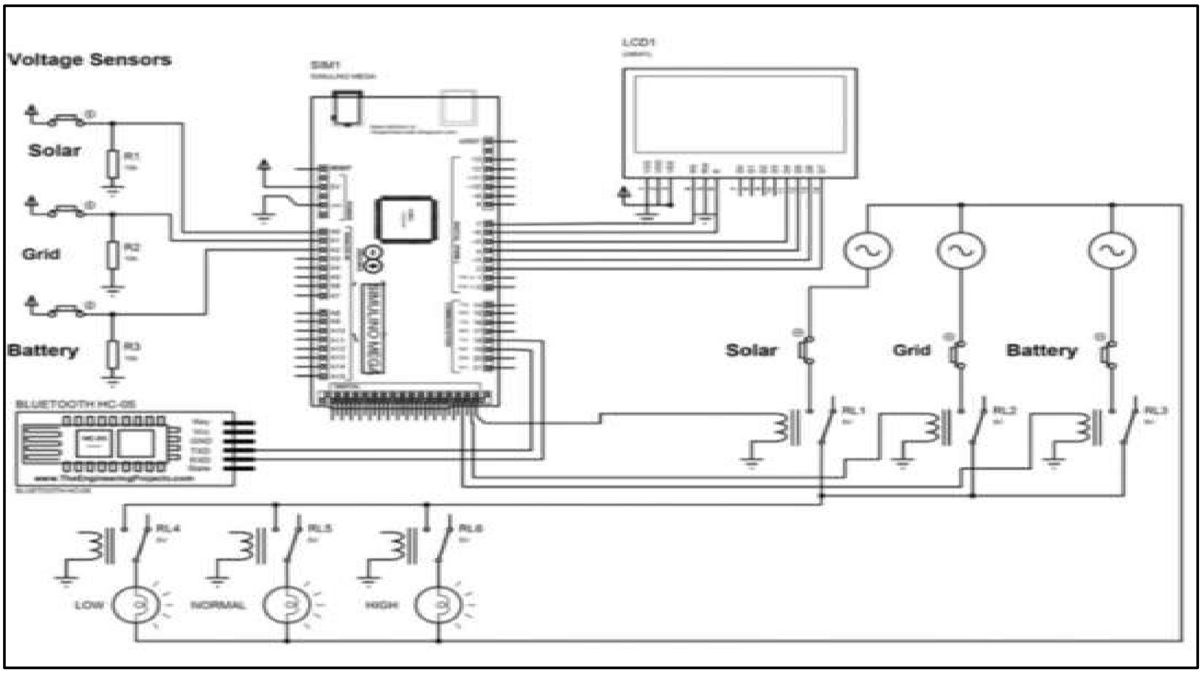

Fig 3: Circuit Diagram of Floating Sun Tracker Hydraulic Solar Panel.

COMPONENTS

COMPONENTS	RATING
Esp32	WROOM-32 ESP32 ESP-32S Development Board 2.4GHz Dual- Mode WiFi + Bluetooth Dual Cores Microcontroller.
Sct 013 current Sensor	Input Current : 100A Frequency: 50HZ-150KHZ
ZMPT101 voltage sensor	Input Current : 0-30A Output Mode: 0-1V 30mA Frequency: 50HZ-150KHZ,Opening Size: 13 x 13mm/ 0.5″ x 0.5″(L*W
Capacitor	100micro farad
Resister	1k ohm
Relay	12/230/AC-DC
Light	9w
Fan	60w
Dryer	25w

VI. CONCLUSION

- It can be easily integrated into a home or small business network, and its data can be accessed remotely through the software application.
- With its powerful features, including real-time energy consumption monitoring, historical data tracking, and the ability to turn off connected appliances, this IoT-based energy monitoring system is an ideal choice for those looking to conserve energy and lower their energy bills.
- Final Thoughts the adoption of IoT for real-time energy monitoring and management is not just a trend but a necessity for a sustainable future.
- As technology continues to evolve, the potential for even greater efficiency and innovation in energy management will grow, making IoT an indispensable tool in our efforts to create a more sustainable world.

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REFERENCES

Journal Papers

[1] Mahmood, S M, Abdulsattar, M, Firas, A Y; Home Automation Management with WLAN (802.11g) and RF Remote Control, Raf. J. of Comp. & Math's, 6(1), 2009.

[2] Aru O E ,Ihekweaba G, Opara F K, Design Exploration of a Microcontroller Based RF Remote Control 13amps Wall Socket, IOSRJCE, 11(1), 56-60, 2013.

Books:

[1] David, N, Design of an Internet Based Security System, NIJOTECH, 29(2) 118-129, 2010.

[2] Diaa, M F, Mahmood, B M, Data Acquisition of Greenhouse Using Arduino, Journal of Babylon University/Pure and Applied Sciences/ No.(7)/ Vol.(22), 1908-1916, 2012.

[3] Anandan, R, Karthik, B, Kumar, K, WIRELESS HOME AND INDUSTRIAL AUTOMATIONSECURITY SYSTEM USING GSM JGRCS, Volume 4, No. 4, 126- 132, 2016.

[4] Asif, O, Hossain, B, Hasan M, Rahman, T, Chowdhury, M, Fire-Detectors Review and Design of an Automated, Quick Responsive Fire-Alarm, 2018.

Chapters in Books:

[1] M. Faisal and A. Mohamed, "A new technique for power quality based condition monitoring," in 17th Conf. Electrical Power Supply Industry, Oct. 2008.

[2] P. Rakesh Malhotra, Dr. R .Seethalakshmi "Automatic Meter Reading and Theft Control System by Using GSM P"Rakesh Malhotra et al. / International Journal of Engineering, 2018.

[3] Home energy management system concepts, configurations, and technologies for the smart grid U Zafar, S Bayhan, A Sanfilippo - IEEE access, 2020 - ieeexplore.ieee.org.

Proceedings Papers:

[1] Robotics D, "DHT11 Humidity & Temperature sensor", 2010,www.micro4you.com/pdf

[2] Violino, B, The 'Internet of things' will mean really, really big data, InfoWorld, 2013. mean-really-- really-bigdata.html.pdf

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