Soil Gravity Battery Technology

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Abstract- The use of more renewable energy sources like solar and wind is making it clear that we need better ways to store energy in a sustainable and efficient way. While traditional batteries are commonly used, they have some big problems, such as being expensive, harmful to the environment, breaking down over time, and not lasting very long. This paper suggests a new energy storage method called Soil Gravity Battery Technology (SGBT), which uses gravity to store energy in a more eco-friendly way. The system works by using renewable energy, especially solar power, to lift a heavy mass. When energy is needed, the mass is let down in a controlled way, and a generator turns the gravitational energy into electricity.

In this setup, the soil acts as a natural support, helping to spread out the weight, reduce shaking, and keep the structure strong.
The system includes a solar panel, a DC motor, a pulley or winch system, the mass being lifted, a generator, and a monitoring unit that uses NodeMCU and ThingSpeak to track voltage and analyze the system in real time. This technology has many benefits, like a long life, less harm to the environment, low maintenance needs, and is good for storing energy in remote or rural areas without a power grid. The research shows that using gravity with soil as support can be a cheaper and greener option compared to regular batteries.

Keywords:Soil Gravity Battery, Gravity Energy Storage, Renewable Energy Storage,Solar Powered Storage System, Gravitational Potential Energy, IoT Energy Monitoring, Sustainable Energy Technology

I. INTRODUCTION

The growing need for renewable energy, like solar and wind, has made it important to find good and long-lasting ways to store that energy. Traditional batteries, such as lithium-ion and lead-acid, have issues like being expensive, not lasting very long, and causing environmental problems. So, people are looking for better alternatives to make energy storage more reliable and eco-friendly.One such technology is the Soil Gravity Battery (SGBT).

It uses gravity to store energy by lifting a heavy object with renewable energy, especially solar. When energy is needed, the object is let go, it falls, and this movement turns a generator to make electricity. The soil around the system helps support the structure and spread out the weight evenly.

This system also uses IoT technology, with NodeMCU and ThingSpeak, to check how well the system is working in real time.

This makes it a cheap, green, and sustainable way to store energy, which is especially useful in places that don't have a regular power supply.

II. PROBLEM STATEMENT

The growing use of renewable energy sources like solar and wind has created a need for dependable and efficient ways to store energy. However, traditional battery systems such as lithium-ion and lead-acid batteries have several drawbacks. They are expensive, don't last very long, degrade over time, and can be harmful to the environment because they contain dangerous materials. These issues make them less ideal for long-term and large-scale energy storage.

Also, many remote and off-grid locations need affordable and environmentally safe energy storage options that require very little maintenance.Because of this, there is a need for a new type of energy storage technology that is sustainable, cost-effective, and reliable.The Soil Gravity Battery Technology (SGBT) solves this problem by storing energy as gravitational potential energy. It works by lifting a mass using energy from renewable sources. This system offers a simple, eco-friendly, and long-lasting way to store energy for renewable energy applications.

III. PROBLEM METHODOLOGY

The Soil Gravity Battery Technology (SGBT) system is a renewable energy storage method that uses gravity to store and create electricity. The project uses a method where electrical energy from renewable sources is turned into mechanical energy and then back into electricity when needed. The main parts of the system include a solar panel, a DC motor, store

extra energy from renewable sources and use it when needed, like during high demand**.**

The solar panel is the main source of electricity and powers the lifting system. This allows the system to or when the energy source is not working.When storing energy, the electricity from the solar panel powers a DC motor.

The motor turns a pulley or winch to lift a heavy weight upwards to a specific height. As the weight is lifted, electrical energy is converted into gravitational potential energy and stored in the raised weight.

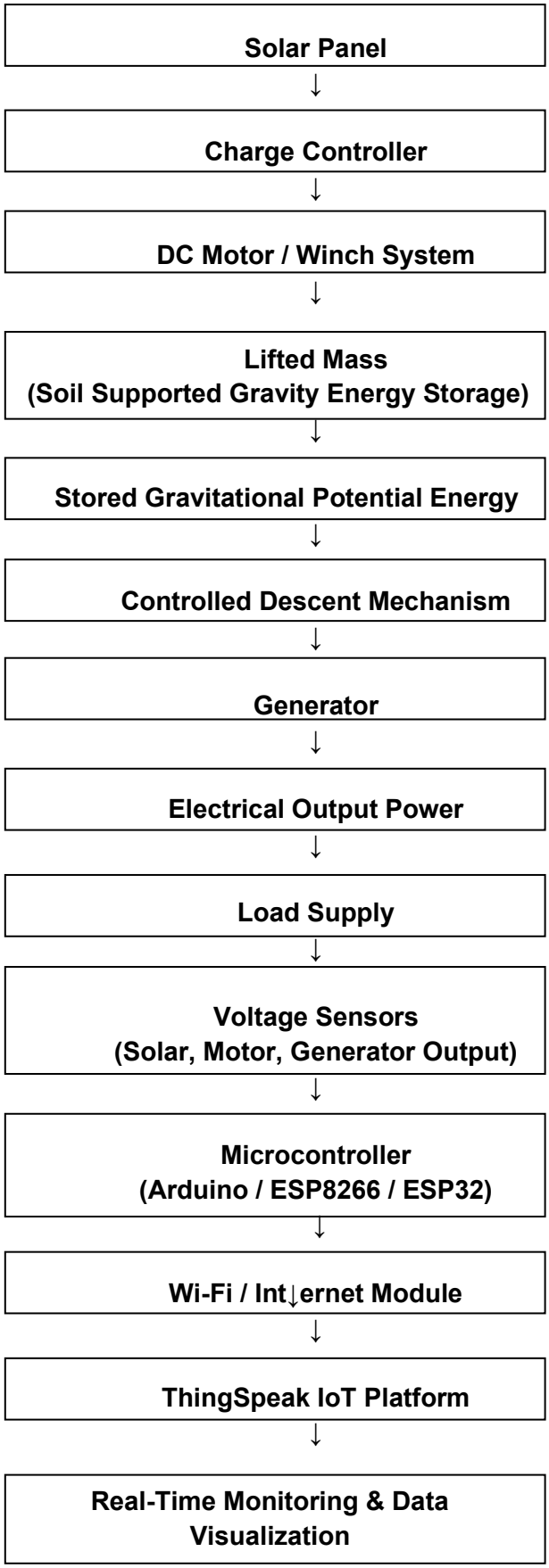
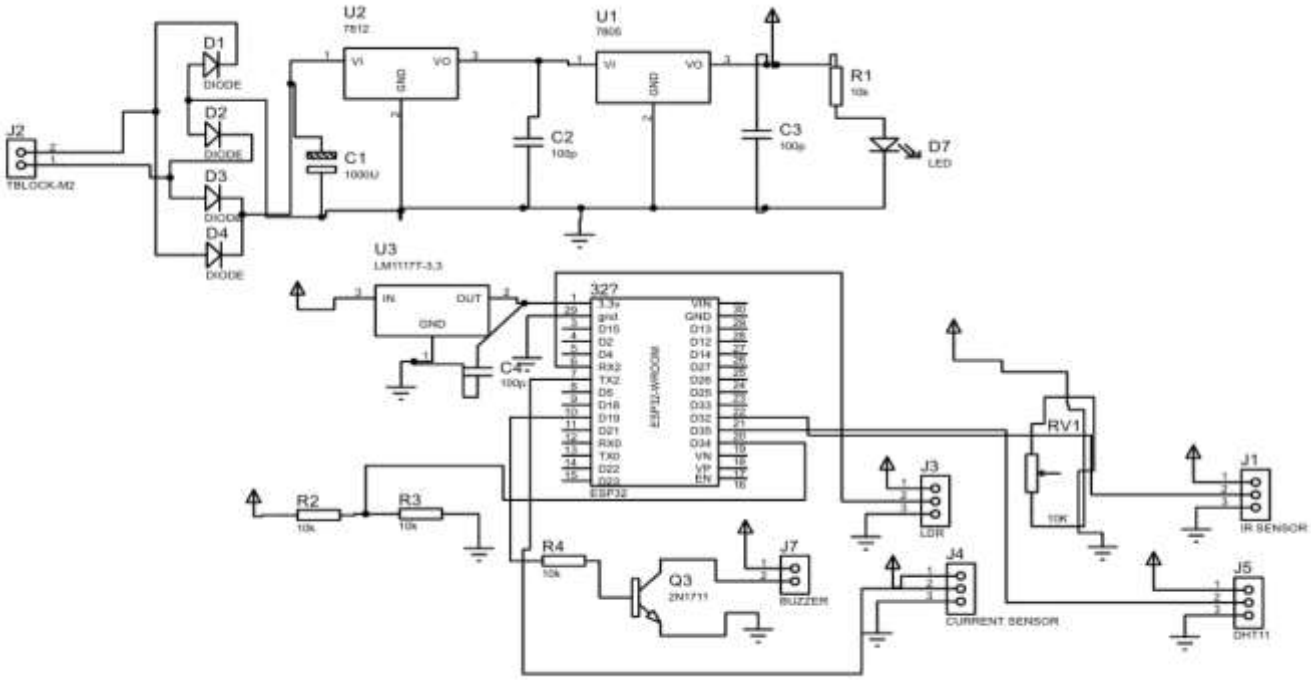


Figure 1 Circuit diagram of the Gravity Soil Battery Storage System



The amount of energy stored depends on the weight of the object and how high it is lifted. The lifting system is built to work efficiently and safely. The use of soil in the system is important, as it provides natural support and helps spread the weight, making the structure stable during operation.

When electricity is needed, the stored gravitational potential energy is converted back into electricity through a controlled drop of the heavy weight.

As the weight falls due to gravity, it turns the pulley system connected to a generator. The generator then turns mechanical energy into electricity, which can be used to power small devices or stored for later. The controlled drop system ensures that the energy is converted smoothly and efficiently while preventing sudden movements that could damage the system.

The soil around the structure acts as a natural support system that makes the setup more durable and safe.Soil helps hold the structure together, absorbs shocks, and spreads out the weight from the lifting system. The design considers proper soil compression and suitable soil properties like density and strength to

make sure the structure can handle lifting and lowering over time without becoming unstable or breaking. This feature makes the system more sustainable and reduces the need for complicated foundations. To keep track of how the system is working, an IoT-based monitoring setup is included.

A microcontroller like NodeMCU or ESP8266 is used to collect electrical data from the solar panel and generator using voltage sensors. The collected data is sent to a cloud platform like ThingSpeak, where it can be seen and studied in real time. This monitoring system allows users to check voltage levels, how well the system is working, and how much energy is being generated from a distance. It also helps spot problems, improve the system's reliability, and monitor performance effectively.

The performance of the Soil Gravity Battery Technology is checked by looking at things like voltage output, how much energy can be stored, how well the energy is converted, and how stable the system is.

The results from experiments help find out if using gravity-based energy storage with soil structures is a practical idea. Through this approach, the project shows that SGBT can be a cost-effective, eco-friendly, and sustainable way to store energy. It is especially useful in rural areas, small-scale renewable energy systems, and off-grid locations where traditional batteries might be too expensive or hard to maintain.

IV. RESULTS AND IMPLEMENTATION

The Soil Gravity Battery Technology (SGBT) system was built by combining renewable energy production, mechanical energy storage, and IoT-based monitoring into one working setup. A solar panel was used as the main source of electricity to power a DC motor. The motor was connected to a pulley or lifting system that raised a heavy object straight up. When the solar panel powered the motor, the lifting system moved the heavy object to a certain height, storing energy as gravitational potential energy. The system was built on compacted soil, which helped keep it stable, spread out the weight, and reduce vibrations during lifting and lowering.

When the system was in discharge mode, the heavy object was let down slowly through the pulley system that was attached to a generator. As the object dropped because of gravity, the pulley started to rotate and turned the generator, creating electrical energy. Voltage sensors measured the output voltage, and the data was checked using an IoT system based on a NodeMCU. The information was sent to the ThingSpeak cloud platform, where it showed real-time voltage levels and system performance details.

Figure 3 Result Graph of Generating Voltage

The tests showed that the system could store extra electricity made by the solar panel and turn it back into electricity when needed.

The lifting system worked smoothly, and the soil-supported structure stayed stable during many cycles. The generator made enough electricity during the mass's descent, proving that stored gravitational energy can be turned into usable power. The IoT system also worked well by showing real-time data and allowing people to watch the system's performance from a distance.The results show that Soil Gravity Battery Technology can work as a simple and eco-friendly way to store energy.

Figure 4 Hardware Setup

Although the prototype made a small amount of power suitable for small uses, it showed the idea of using gravity-based energy storage with soil support. The study shows that this technology has room for more development and bigger use, especially in rural or places without regular power, where low-cost and sustainable energy solutions are needed.

V. CONCLUSION

The study introduced the design and setup of Soil Gravity Battery Technology (SGBT), which is a sustainable way to store energy using gravity. The system showed how extra energy from renewable sources, especially solar, can be saved by lifting a heavy object and then turned back into electricity when needed by letting it slowly come down connected to a generator. The system used a pulley setup, a generator, and an IoT monitoring device to store energy and track how it's working in real time.

The experiments proved that the system can change electrical energy into mechanical energy and bring it back when necessary, showing that gravity-based energy storage is possible.

Using soil as the base helped make the system stable, spread out the weight, and control vibrations, which made it safer and more reliable. The IoT system, using NodeMCU and cloud platforms, let people see data in real time and analyze how the system is performing, making it more efficient to operate.

In general, Soil Gravity Battery Technology is a cost-effective, eco-friendly, and long-lasting way to store energy compared to traditional batteries.

While the first version made only a small amount of power, it has big potential for future improvements. With more development and scaling, this tech could be used in renewable energy setups, bringing electricity to remote areas, and storing

power without the grid, helping create more sustainable and dependable energy solutions.

VI. FUTURE SCOPE

The Soil Gravity Battery Technology (SGBT) has a lot of potential for future growth as a sustainable way to store energy. In the future, the system can be made better by increasing the mass and lifting height, which will allow it to store more energy and produce more electricity. Using efficient generators, better pulley systems, and improved control systems can also make the whole system work more effectively.

More research can focus on adding advanced IoT monitoring, automation, and smart control systems to help with performance tracking and remote management.

Also, better soil engineering and structural designs can make the system more stable and long-lasting for bigger installations. With these improvements, SGBT can become a cost-effective and eco-friendly solution for storing renewable energy, providing power to rural areas, and supporting off-grid power systems.

VII. REFERENCES

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