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Construction of Cargo-Rail for Jungles That Provides Wireless Power to the Isolated Station

B. Shiva Jyothi, B. Manideep, G. Jashvanth, S. Ganesh

U.G Students, Department of Electrical and Electronics Engineering, Anurag University, Venkatapur,

Medchal-Malkajgiri District, Hyderabad, Telangana, India

ABSTRACT: The cargo-rail is designed for collecting various forest products, such as hard wood, soft wood, spices, tamarind, and honey, etc. This paper addresses the issue of replacing diesel generator rails in forests, which are a major concern for fuel consumption and accidents. Since the Cargo-Rail travels through a risky route, it is designed as a driver-less system, travelling between two reference points automatically. When the rail reaches the material collecting point in the jungle, it stops automatically and provides electric energy to the lighting system without using any connecting cables i.e., wireless power using coils. The lighting system is essential for loading the goods, as the availability of supply source in the jungle is critical. The demo module is constructed with a moving mechanism with four grooved metal wheels and a DC motor driven by the rear wheels. The rail is simulated using an aluminum rail track laid over a 4' length wooden plank. Reference points are identified through limit switches, and the corresponding switch is activated automatically when the rail reaches any reference point. The start button must be activated after loading the cargo-rail and start button is activated by the loading person. Then it will reach the starting point. The rail is powered by a high-power rechargeable battery, which is used to energize the power transmitter automatically when the rail reaches the loading point. A lighting system is designed with 25 to 30 high-glow LEDs attached to a small pole to simulate an electric pole. Point-to point power transmission technique is implemented, with a resonating coil theory adopted for transmission of power from one coil to the other.

KEYWORDS: IR sensors & IC567, 12V rechargeable battery, 5v regulator, self oscillator circuit ,Power transmitting coil, power receiving coil, Time delay circuits, Limit switches, DC motor, relays, battery charger, etc.

I. INTRODUCTION

The project intends to use a commodities rail platform to move forest products such as wood, rubber, fruits, and honey. The cargo-rail model uses timber, a common material for contemporary architecture, and it automatically activates a light source when the train reaches a rainforest station. The construction of cargo-rail systems for jungles that provide wireless power to isolated stations is a modern innovation aimed at improving logistics and connectivity in remote areas. While there isn't a specific historical event for this exact scenario, the concept draws upon advancements in transportation, energy transmission, and infrastructure development.To find the jungle station, an IR sensor and an IC 567 proximity detecting circuit are incorporated in. An imitation of the moving machine is made using grooved wheels and a DC motor. Wireless power transfer technologies use electro-magnetically driven vehicles (EMP) and air core coils.Because wireless power transfer technology is portable and offers real-time applications, it has become a hot topic. The increasing number of portable devices and the need for wireless battery chargers are driving the development of wireless power transfer. In 1891, Nicole Tesla presented the concept using a three-wound coil-powered incandescent light. William Brown's invention of the rectenna rectifying antenna significantly advanced microwave power transmission. Inductive coupling, microwave power transmission, and laser technology for electrical power transfer are the three types of wireless power transfer. Effective power transfer between two coils spaced a few meters apart is made possible by mutual induction, which produces a magnetic field around the transmitter coil.
However, in order to transfer the most electrical power possible, choosing the optimal resonance frequency is crucial.

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II. CIRCUIT DESCRIPTION OF WIRELESS POWER SOURCE

Electric power can be transmitted over the air without the need for wires via wireless power transmission, or WPT. Because magnetic field coupling is non-radiative and has higher efficiency, it is recommended. With the use of power MOSFETs, a low power transmitter circuit prototype is shown in this project. Electronic devices such as oscillators, filters, tuners, and frequency mixers require an LCcircuit, which consists of an inductor and capacitor to store energy at the resonant frequency. The harmonic oscillator function of the circuit mimics the oscillation of a pendulum or sloshing of water, occurring thousands to billions of times per second.

DESCRIPTION OF STATION SENSING CIRCUIT

Infrared (IR) sensors and the IC567 circuit are used by the forest station sensing circuit to determine the destination or stopping point. When the model rail reaches the jungle platform, the IC567 circuit, which is connected to the transmitting and IR signal detecting LEDs, activates the relay. To generate tone frequency, the tone decoder IC LM567 uses two infrared LEDs for signal transmission and reception. A voltage-controlled oscillator controls the decoder's center frequency, while external parts are utilized to adjust the output delay and bandwidth. To lessen noise signals, an infrared receiver is connected to the 567-tone decoder IC's third pin.

DESCRIPTION OF TRAIN CONTROL CIRCUIT

A time delay circuit uses relays and control keys to create motion in a moving machine. A DC motor, relays, limit switches, switching transistors, and control keys are all used in the motor driving circuit of a rail system to control movement. The motor has two limit switches to restrict movement at particular places, and it rotates in both clockwise and counterclockwise directions. The polarity of the relay's single change over contact controls the polarity of the motor.

Transistors, which use electrons and holes as charge carriers, are crucial semiconductor parts used in electronic applications. Relays are frequently found in gate logics and are employed in Boolean processes, long-distance telegraphy, and telephone exchanges. DC motors are widely utilized, reasonably priced, and easy to use. They can draw power from a battery, DC power source, or drive circuit. Limit switches offer dependability and minimal noise by controlling the model rail's mechanical transmission system.

DESCRIPTION OF POWER SOURCE

The complete system is powered by a 12v-2Ah rechargeable battery. 400ma of current is produced by a 13v DC charger when it comes to charging the battery. Depending on the current, charging can take up to five hours to complete. The battery needs to be charged often because it never completely drains.

The model train requires 300 milliamperes of current from the battery in order to operate, which is the main purpose of the device. The battery may last up to two hours, and both circuits' average current usage is regarded as 1 amp.

BATTERY

When energized, chemical voltage sources are independent electrical energy sources that provide electricity. They may be charged using an appropriate power source, such as a solar panel or mains supply, and are frequently employed in mobile applications. These maintenance-free batteries are made up of several cells that raise voltage and current. Depending on the process by which chemical energy is transformed into electrical energy, they are categorized as primary or secondary. A re-chargeable storage battery, capable of withstanding two hours, is used in this project. These are sealed lead acid rechargeable batteries that require no maintenance and offer exceptional performance, stability, and economy. They work well for power backup applications and portable instrumentation.

CHARGING METHOD

Charge techniques such as limited current and stable voltage have a big impact on battery life and performance. For optimal capacity, longevity, and cost-effectiveness, a limited current in conjunction with constant voltage charging is advised.

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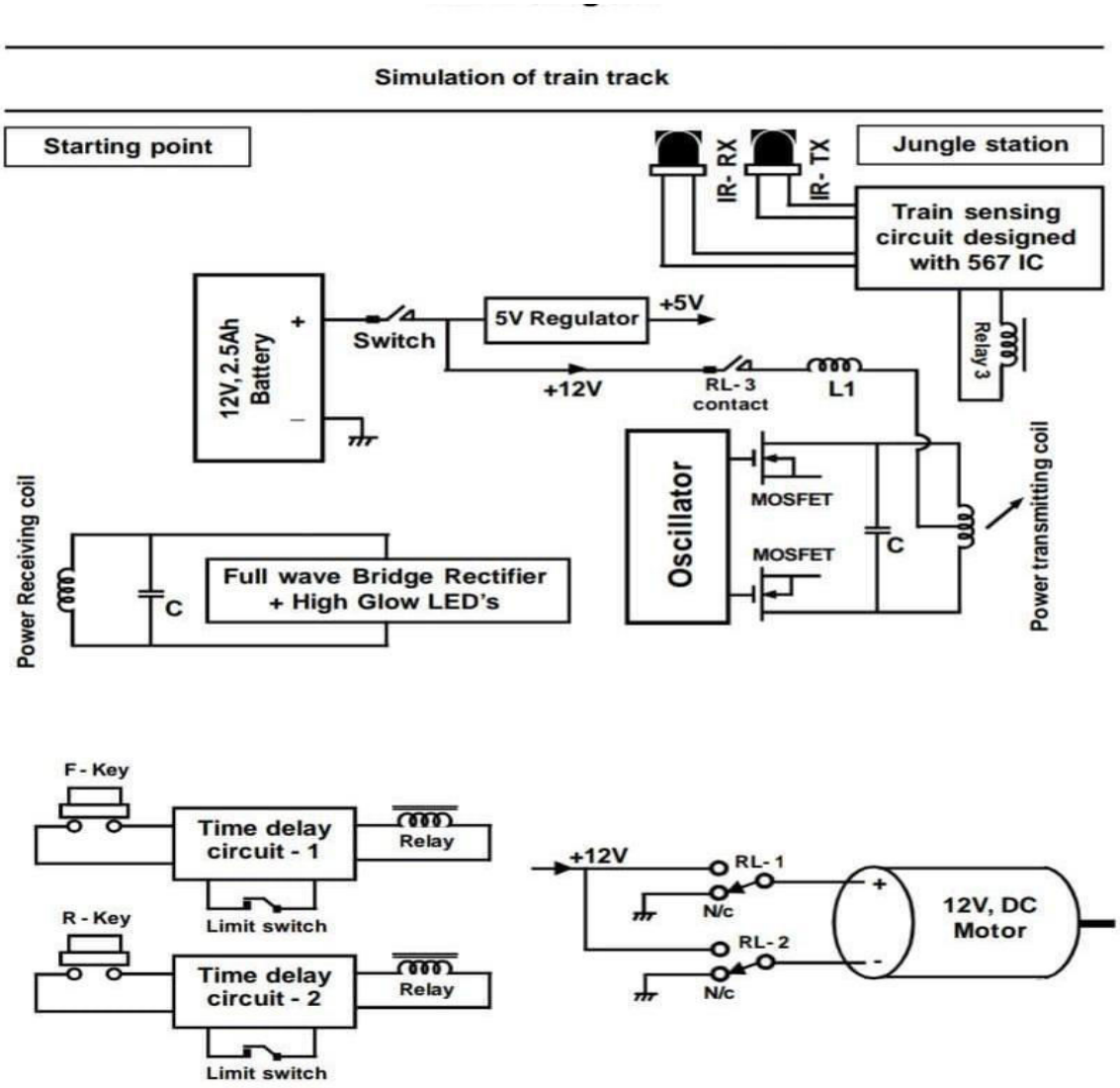
BLOCK DIAGRAM



STEP BY STEP PROCEDURE:-

The cargo-rail is constructed using a spear gear mechanism which is used to move it on a aluminium track. The rail is powered by a battery. The reference points are located at starting and ending points and limit switches are placed at the reference points. Firstly, the rail is powered to train control circuit in which it consists of forward and reverse moving relays and a switch to operate it. When the switch is On and forward button it pressed it moves forward and when reference point is reached limit switches gives indication. As the rail reaches the loading point IC567 sensor senses the object and give message to oscillator circuit then NC coil in it operates and powered by a battery. Then the transmitting coil is energized and when it reaches the loading point it couples with the receiving coil by converting DC to AC using LC tuning circuit and lighting system is ON. When reverse button is pressed, the rail moves back to the initial position and reaches the reference point.

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III. RESULTS

A cargo rail system using wireless power technology could revolutionize transportation logistics by eliminating the need for traditional power lines and energy storage. This would increase efficiency, reduce maintenance costs, and increase cargo capacity. The project could also reduce environmental impact and expedite transit times. Furthermore, the use of wireless power could pave the way for sustainable transportation infrastructure advancements.

IV. CONCLUSION

Wireless power transfer is an important subject with applications in many different domains. In order to better understand the functions of electro-magnetic fields, resonant inductive coupling, LC networks, and synchronization between two inductive coils, this project focuses on wireless energy transmission between magnetically coupled coils. A variety of coils were used in the experiments, but 21 SWG wire with a 5" ring size was the main emphasis. The power receiving coil was unable to drive the moving mechanism, resulting in a shorter distance despite the two coils' measured distance of 70mm.The prototype module seeks to construct a low power transmitter because of the scarcity of power sources and financial constraints. The group is confident in its ability to construct a high power transmitter and extend range after completing experiments. Tuning resonant circuits, which are made up of capacitance and inductance, to resonate at the same frequency is the primary factor. The technology can be used to run electric cars and is now being researched for powering and charging portable electronics like cell phones. A highly resonant coil's magnetic field is made to oscillate in order for resonant transfer to occur.

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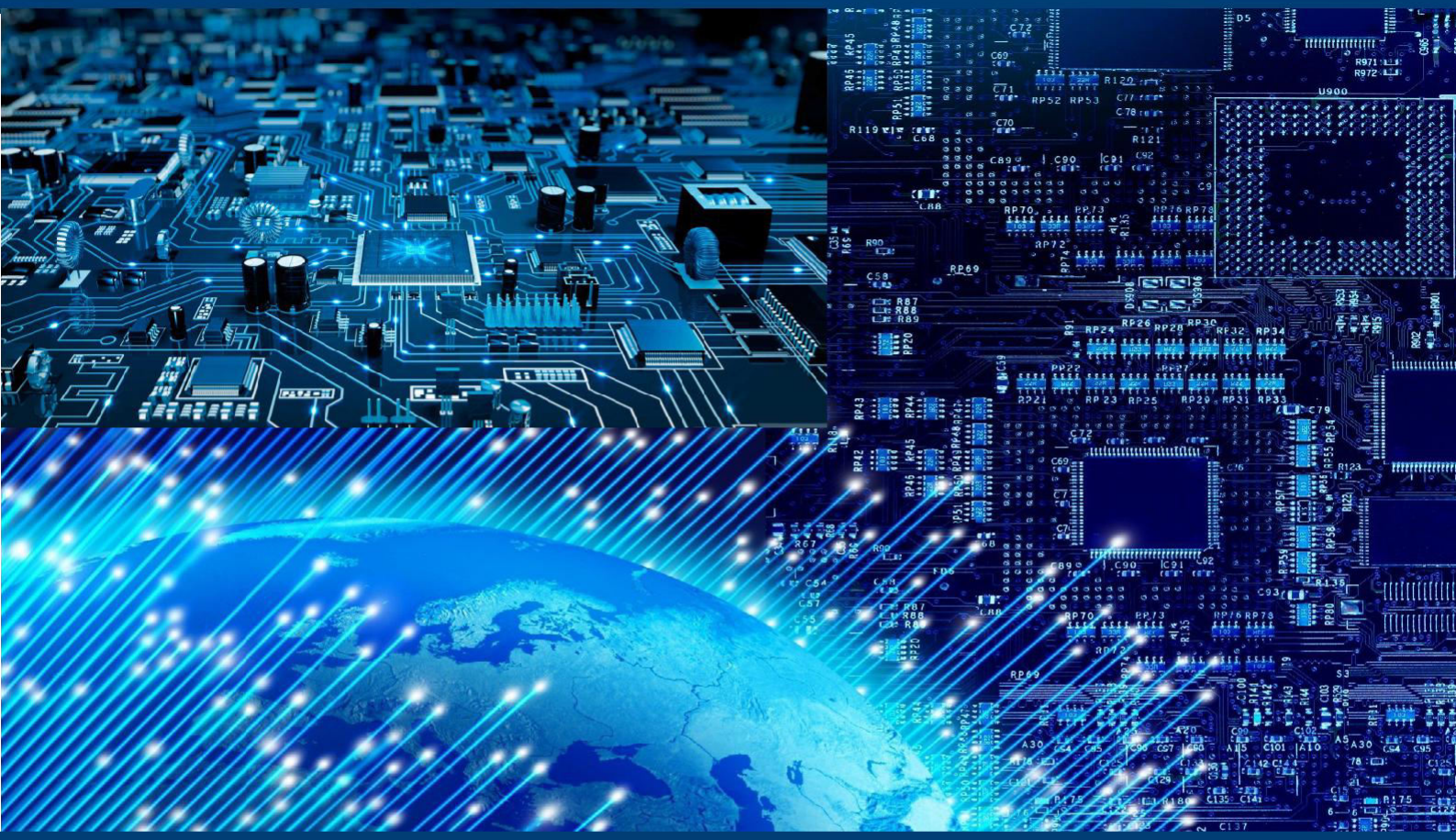

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