DRIVERLESS LOGIC TRAIN WITH AUTO CHARGING

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ABSTRACT

The logic train demo module presented here is aimed to design self controlled driver less train which is supposed to be follow the track side signals. Monitoring the track side signals manually and controlling the train accordingly is the existing method, in this process due to the human errors, sometimes accident may take place[5]. To avoid human errors, this automatic system is developed such that the system itself monitors the trackside signals and controls the train accordingly. In addition, the model of train designed here doesn't require "pantograph" and it runs with the support of back up battery source. For this purpose rechargeable battery is used and it will be charged automatically when the train is halted due to the red signal at any where or at the station. Here the charging method is designed as wireless, such that when the train is halted, it will be positioned towards the power transmitting coil by which the battery receives energy through power receiving coil. This power transmitting coil must be arranged between the track at halted points and where as power receiving coil must be arranged below the chassis of the moving mechanism, is that under the rail[6]. To know the battery status, is it charging or not, the moving mechanism is equipped with digital volt meter.

Usually track side signal post contains Red, Green and Yellow lights, and the train driver must follow these signals. Green signal indicates that the train driver can run the train at its allowed maximum speed, if the driver finds yellow signal he has to reduce the train speed by less than 25Kmph. Similarly Red signal indicates that the train must be stopped immediately. This is the common protocol followed by the engine drivers, but sometimes, due to the human errors, due to the fog, due to negligence of driver, if the signal is neglected or it is not visible due to the thick fog in winter, severe accidents may happen. To avoid this kind of situation, here autonomous train is designed by which the train itself will be controlled automatically according to the track side signals. Depending up on the signal present in the post, proportionate digital code will be generated from the signal post and this data will be transmitted through optical devise.

Since the running engine equipped with sensor package, as it reaches near to the signal post, data will be acquired and after decoding the data through embedded system, motor will be controlled accordingly. To prove the theme practically, the demo module contains low speed train model and it runs over the metal track. Signal posts will be arranged side by the track, since it is a prototype module, 3 posts are used for demo purpose. Train is simulated with motorized trolley, as this trolley is having grooved metal wheels, it runs over the track.

Key words: Simulation of train with motorized moving mechanism, Signal data transmitting units & main processor are constructed with 4 numbers of 89c2051 Micro Controller chips, IR sensors, Signal post with auto setting keys, DC motor, L293D H Bridge IC, metal track, Alarm, rechargeable battery, PSU, self oscillator circuit built with power Mosfets and is used to transmit the electric energy, power transmitting coil, power receiving coil, DMM, etc.

1.INTRODUCTION

With the use of modern technologies, wireless charging of batteries may now be done over short distances without the need for cords. Wireless charging has the advantage of being quicker and simpler to use. We can avoid constantly plugging in and unplugging; all we have to do is align the power transmitting coil (between the tracks) in a straight line with the power receiving coil, which is positioned beneath the model train's chassis at a specific distance, and the battery will begin charging on its own. Here, the power transmission coil is placed close to the signal post. When the light turns red, the train will automatically stop, allowing the wireless charger to charge the battery. Any non-conductive material, such as wood, plastic, concrete, etc., may transfer the electric energy produced by the power transmission coil [8]. As a result, this coil can be buried in concrete so that the battery will always be charged when the train stops over it. Since this module is a prototype, its coil will remain open for demonstration purposes. The battery will be charged when a power receiving coil is placed over it at a certain distance of around 20 to 30 mm. When considering this charging technique for an electric train battery, it is necessary to place the power receiving coil underneath the model train's chassis[6]. The rate at which the battery is charging may be seen with the use of a digital volt metre that is linked to the battery terminals.

A 12-volt, 2-ampere rechargeable battery is used, and a volt metre is utilised to continually check the battery's terminal voltage. Power transmission and receiving coils often play a key part in wireless chargers' ability to charge batteries. This approach eliminates the need for conducting wires by using coils to transfer energy to one another[9].The resonant inductive coupling method, often referred to as electro-dynamic inductionis usedThis approach wirelessly transfers electrical energy in the near field using two magnetically connected coils in resonant circuits with the same frequency[4].Resonant transfer winds a coil ring with an oscillating current to produce a magnetic field.The greatest amount of energy may be captured by bringing a secondary coil close to this magnetic field. This energy can then be transformed into a pure DC source and utilised to charge a battery[5]. The output is not controlled by voltage fluctuations, which may be seen while the model train is operating and charging.

2.LITERATURE SURVEY

The introduction of autonomous vehicles (AVs) into our transportation system has the potential to be both disruptive and advantageous[1]. Travel patterns, traffic, and vehicle safety may all be impacted by this new technology. All told, significant societal benefits of AVs in the form of reduced travel times, accident saves, fuel economy, and parking advantages are projected to reach close to $2000 annually for each AV and might potentially approach over $4000 when total crash costs are taken into consideration. Implementation and mass-market penetration obstacles still exist, however. The initial expenses will probably be too high[2,3]. In the United States, state-level rather than federal standards are being created for licencing and testing, which might result in variations throughout states[5].Security issues persist, liability specifics are still unclear, and a default lack of privacy for private travel may become the norm in the absence of new privacy legislation. The implementation's details, consequences, and relationships to other components of the transportation system are all yet unclear.The federal government should do further study in these fields and develop an AV licencing structure that is recognised nationwide, while also establishing suitable liability, security, and data privacy regulations.

The effect of an autonomous vehicle (AV) environment on the mobility of marginalised groups, including adult non-drivers, has been evaluated by earlier research[2]. As kid passengers are probably going to be a part of AV ridership scenarios in the observable future, what is presently uncertain is how AVs will improve the mobility of children who are also mobility handicapped [7].Our research gathered the perceived advantages and concerns of autonomous vehicles (AVs) from a convenience sample of US parents whose children depended on them for mobility in order to answer this issue. Parental aspirations to travel in AV and their level of technological preparedness, together with the demographic profiles of the kid (age, age group, and restraint system) and parent (sex), were revealed to be significant predictors of prospective AV acceptance and effect.

3.CIRCUIT DESCRIPTION OF WIRELESS BATTERY CHARGER

When it comes to wireless power transmission, it's an effective method of moving electricity over the air without the need of a cable. Power may be transferred using WPT via resonant induction for mid-range gearbox and inductive coupling for short-range gearbox. This technique makes it feasible to provide electricity to locations where running traditional cables is challenging[7]. At the moment, inductive coupling is a hot topic, and researchers from all over the globe are working hard to create effective power transmitters. Electromagnetic induction is the most widely used wireless power transmission method[5].Three requirements must be met by the wireless power transfer system in order to transmit midrange power effectively: (a) high efficiency; (b) big air gap; and (c) high power. Despite its poor efficiency, microwave power transfer has a great transmission range. Due to the electromagnetic waves it emits, this technology may not be very effective for near field power transmission. Electric field coupling may be used for wireless power transmissionIt also creates an inductively loaded electrical dipole, an open capacitor or dielectric disc, by putting two equal and opposite electric charges or magnetic poles of the opposite sign at a minimum distance.

Any solid metal object between two coils affects electric field coupling significantly.Because superfluous items in a magnetic field have magnetic characteristics like empty space, magnetic field coupling may be desired. An electromagnetic induction process has a limit[8]. Magnetic field coupling works better.as it transmits electricity non-radiatively. On the other hand, by using magnetic coupling and the resonance phenomena, the power transmission range may be expanded. When an electric charge flows across space or via an electrical conductor, a magnetic field is generated[4]. The geometric shapes of flux lines in an electrostatic field and magnetic flux lines formed by moving charge (electric current) are similar. Conceptualization The electromagnetic principle governs the action of inductive or magnetic coupling. Wires produce magnetic fields when they touch other magnetic fields. Inductive coupling uses magnetic fields to transfer energy between wires.This project develops a low-cost wireless power transmission technology. Low-power transmitter circuits in the prototype module use power MOSFETs. A push-pull connection between two Mosfets boosts main coil current.

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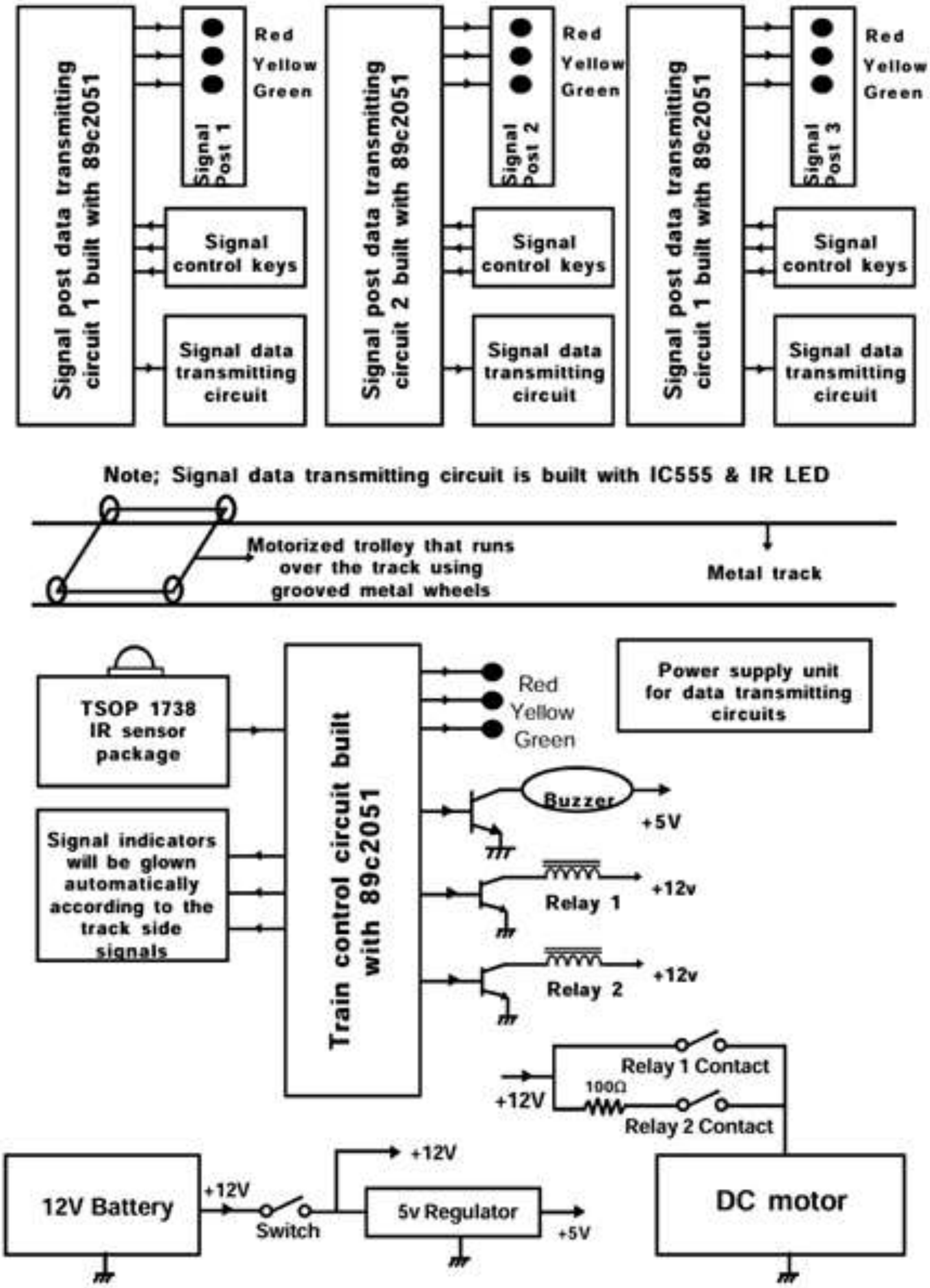

Figure1. Driverless logic train with auto charging

In order to prevent both Mosfets from conducting at the same time, switches and Mosfets are powered sequentially—either one after the other or simultaneously—by a diode connected in feedback mode[5]. Due to the centre tapping of the main coil and its division into two portions, a matching Mosfet will be used to separately energise each segmentSimilarly, if the bottom Mosfet is electrified, the top remains off, but if the top Mosfet is energised, the bottom remains de-energized. When switching in this way, the rapid recovery diodes coupled in a feedback loop determine the switching frequency.

A) LC CIRCUIT DESCRIPTION

An LC circuit is an electric circuit that consists of a connected inductor (L) and a capacitor (C). It is sometimes referred to as a tuned, resonant, or tank circuit[3]. The circuit may act as an electrical resonator and electronic tuning fork by storing energy that oscillates at its resonant frequency.Using LC circuits, signals at certain frequencies may be generated or extracted from more complicated signals at a desired frequency[1]. They are essential parts of a lot of electronic equipment, appearing in circuits like frequency mixers, oscillators, filters, and tuners. An LC circuit is an idealised model because it makes the assumption that energy is not lost via resistance. Any real-world use of an LC circuit will always include some loss because of the little but persistent resistance present in the wires and component parts. An LC circuit's typical function is to oscillate using a DC source to produce ac signals that may be used to successfully drive inductive loads.

Energy is stored by the inductor L in its magnetic field and by the capacitor C in its electric field. In this setup, the circuit begins to oscillate, causing the L and C to charge and discharge alternately[7]. Depending on these two components, the tuned circuit oscillates hundreds of times each second. LC circuits may store energy by oscillating at their natural resonant frequency. The magnetic field (B) of an inductor changes with current, whereas the electric field (E) of a capacitor varies with voltage. Current flows through an inductor across a charged capacitor, generating a magnetic field and reducing its voltage.The capacitor will eventually lose all of its charge and the voltage across it will drop to zero[6]. Nevertheless, since inductors resist changes in current, the current will persist. The capacitor will start to receive a voltage charge from the current that is opposite to the initial charge. Faraday's rule states that in a decreasing magnetic field, the EMF drives the current that charges the capacitor. When the magnetic field disappears, the current stops and the capacitor stores the charge again, but with the opposite polarity. Repeat the cycle with the inductor current flowing in the other direction.

Through the inductor, charge oscillates between capacitor plates. Energy oscillates between the capacitor and inductor until internal resistance stops it. The tuned circuit is often a component of a larger circuit that oscillates constantly when an alternating current is applied to it[4]. Resonance occurs when they are at the natural oscillation frequency. The activity of the tuned circuit, also known as a tank circuit, is theoretically described as a harmonic oscillator and is analogous to the back-and-forth swinging of a pendulum or the sloshing of liquid in a tank. As previously stated, the natural frequency is defined by the capacitance and inductance levels. Electronic equipment often has tuned circuits that oscillate at speeds of hundreds to billions of times per second.

B)POWER RECEIVING CIRCUIT DESCRIPTION

The LC circuit that is used on the main side—where power is transmitted—must be used on the secondary side. There should be no variations in the wire gauge, number of turns, or coil size between the secondary and primary coils. For correct resonance coupling, the value of the capacitor in this instance should also match that of the main capacitor[3]; high-quality capacitors are recommended. Affected distance may be enhanced if the secondary coil and main coil are precisely synchronised.

The secondary coil's output is converted to pure DC in this step by building a full wave bridge with the aid of four rectifiers and using a filter capacitor to produce pure DC. We conducted several experiments on our trail rides by wrapping various coils with various gauge magnetic wires of various diameters. The goal of all these trials is to choose an effective coil that will allow the secondary coil to produce its maximum voltage[2]. Distance may also be significantly increased with higher voltage. In the end, we have decided on a single coil with 8 turns in the secondary and 4 + 4 turns in the primary. The coil ring size is two and a half inches, and the wire thickness is 21 SWG. Since there is no load voltage and a load of 120 milliamps applied across the DC source lowers the voltage to 4V, we were able to get approximately 15V DC with this coil at a distance of 80mm. After connecting twelve high glow LEDs, we discovered that they were blazing brilliantly at a distance of six centimetres from the main coil.

C)DESCRIPTION OF WIRELESS ENERGY

The main focus of this research is resonant inductive coupling, which is discussed in this chapter. Resonant inductive coupling is the near-field wireless transfer of electrical energy between two magnetically connected coils in resonant circuits with the same frequency[1]. Also called electrodynamic induction. This happens in a resonant transformer, which has two linked LC circuits with two high Q coils wrapped around the same core and capacitors across the windings.Resonant transformers are often employed in switching power supply and band pass filters in radio systems. Another use for resonant inductive coupling is wireless power systems. The two LC circuits are housed in different devices[6].A transmitter coil in one sends electricity to a resonant reception coil in another device across a distance between them. With the use of this technology, portable electronics like tablets and mobile phones will be able to be charged and powered remotely without the need for conducting cables.

By creating a coil ring with an oscillating current, resonant transfer operates. An oscillating magnetic field is produced as a result. Any energy applied to the coil goes away rather slowly over a very long number of cycles due to its high resonant nature. However, even if it is rather far away, if a second coil is brought next to it, the coil may absorb the majority of the energy before it is lost. Since all gear is maintained well inside the 1/4 wavelength range, the fields that are employed are mostly non-radiative near fields,also known as evanescent waves, and they radiate very little energy from the transmitter to infinity.The CCFL inverter is one of the uses for resonant transformers[5]. Resonant transformers are also used to link between stages of super-heterodyne receivers Tuned transformers in intermediate-frequency amplifiers give the receiver's selectivity. Unlike high voltage electrostatic devices,the Tesla coil is a resonant transformer circuit that generates very high voltages and currents[9]. The underlying premise of suggested short-range wireless power systems is resonant energy transmission.

When continuous or instantaneous energy transfer is necessary but cable connections are difficult, unsafe, or impossible, wireless transmission may be useful. An successful wireless power transfer approach will also enable breakthroughs in a range of disciplines, such as embedded computers, mobile computing, sensor networks and tiny robotics[6]. When devices must function without cables, the primary design motivation is often the need to reduce energy usage. In these kinds of applications, energy consumption often limits functionality. This paper's study is motivated by the possible use of magnetic resonant coupling to transmit wireless power transfer (WPT) from a source coil to a single load.

It is noticed that a small load of a single LED can be illuminated up to a maximum distance of 50 centimetres without the intermediate coil, and that led can be lit up to a maximum distance of 70 centimetres with a voltage measured at 2 volts when the intermediate coil is present. When constructing medium power inductors,this factor is taken into account[4]. There are still a few tests to be done with this technology in order to produce better results, but the day when wires are unnecessary is not far off. With the use of WPT technology, electricity can now be sent to areas that would not otherwise be feasible or feasible. This paper's goal is to develop and put into practice a system for wirelessly transmitting electricity over space. The power transmitter used in this project uses solar energy as a fundamental DC power source.

In the realm of wireless power transmission, magnetic coupling is a time-tested and well recognised technique. However, the magnetic field is only useful over relatively small distances due to its rapid depreciation. A longer range of power transmission may be achieved by using resonance in magnetic coupling Magnetic resonant coupling may be the most efficient approach known for near field wireless power transmission. The preceding chapter displays the block diagram for the whole experiment [2,3]. A solar power source, a rechargeable battery, an oscillator, power MOSFETS to operate the power transmitting coil, a remote control unit with RF modules, secondary coils, and a lighting load make up this system. We found that in our experiment, a lighting load of around 250 milliamps efficiently energised at a distance of 6 to 8 cm.

The electromagnetic principle powers inductive and magnetic coupling. Inductive coupling uses magnetic fields to transfer energy between wires. Two circuits are magnetically linked when a component of their magnetic flux interacts.This permits energy to flow from one circuit to another[1].This energy transfer is carried out via the common magnetic field between the two circuits.Increasing the number of turns in the power transmitting coil may improve the power transfer efficiency of magnetic coupling. Other elements that affect this process include the current intensity, the coil's cross-sectional area, the strength of the radial magnetic field, and the resonance frequency. An item vibrates due to a phenomenon called resonance that occurs when energy at a certain frequency is applied. Resonance is the term used in physics to describe a system's (typically linear system's) propensity to oscillate more intensely at some frequencies than at others. The resonant frequencies of the system are these.

D)HARDWARE DETAILS

Building a specified model is necessary in order to demonstrate any project's practicality for demonstration purposes[8].To complete the task at hand, adequate hardware, such as mechanical, electrical, and electronic components, is necessary. When these components are merged or work together, project results may improve. This is a genuine project, hence the abstract must be supported with evidence. A perfect project report requires active hardware like integrated circuits (ICs) and other unique components.

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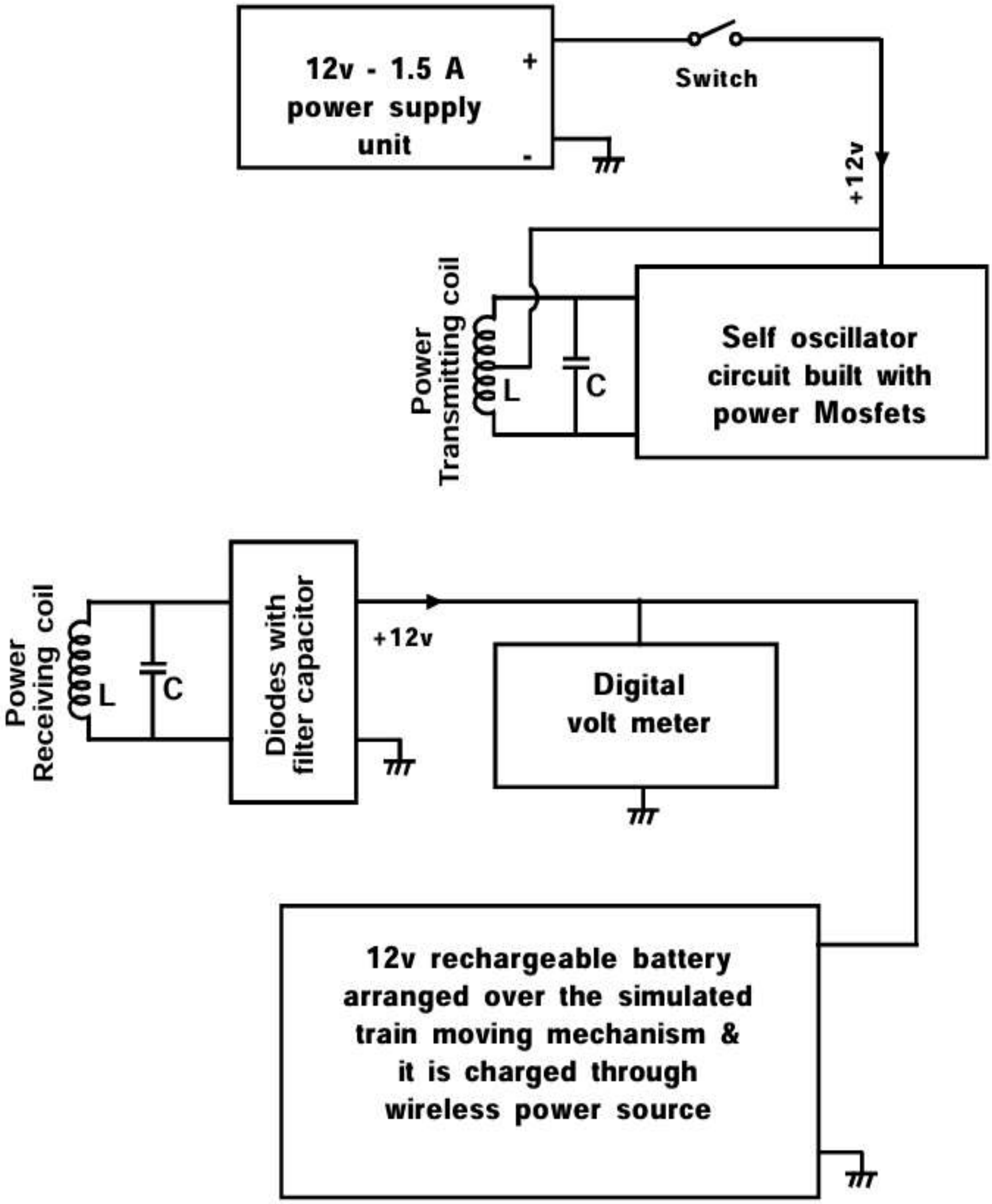

Figure 2. Driverless logic train with auto charging

Hardware constructed from electronics is In the context of technology, hardware refers to all of the physically touchable components that comprise an electromechanical or electrical system. An embedded system consists of sensors, control circuits that include motors, relays, switching devices (such as power Mosfets, transistors, and so on), and a processing unit (which is often formed by microcontroller chips).[9] Firmware, software, and hardware all work together to make a system operate. A collection of codes that are loaded into a microcontroller chip is called software. LCD screens are often used to monitor system performance or outcomes. However, for the purposes of this project, visual indications are needed rather than LCD.

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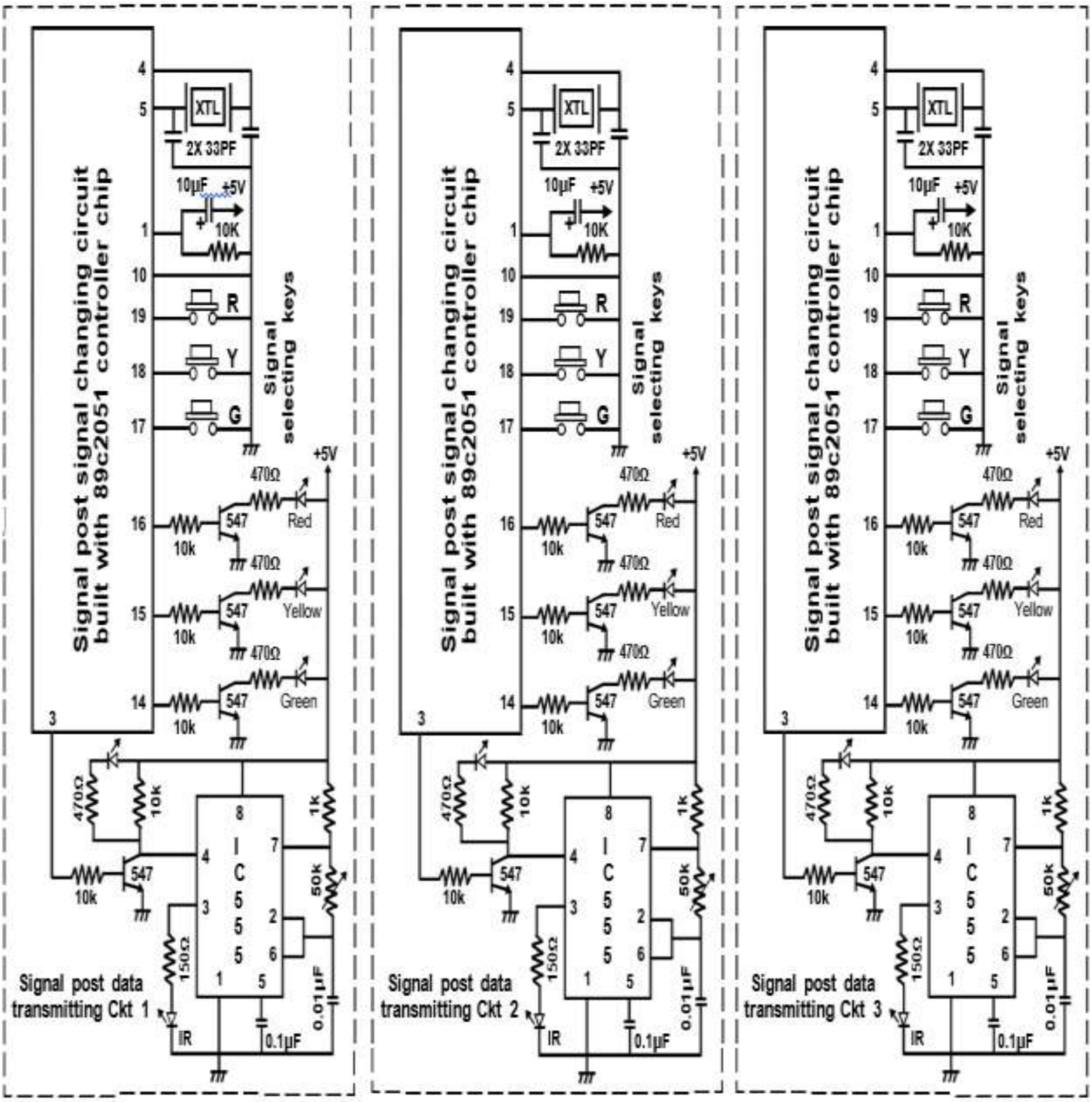

Figure 3. Driverless logic train with auto charging - Part – 1

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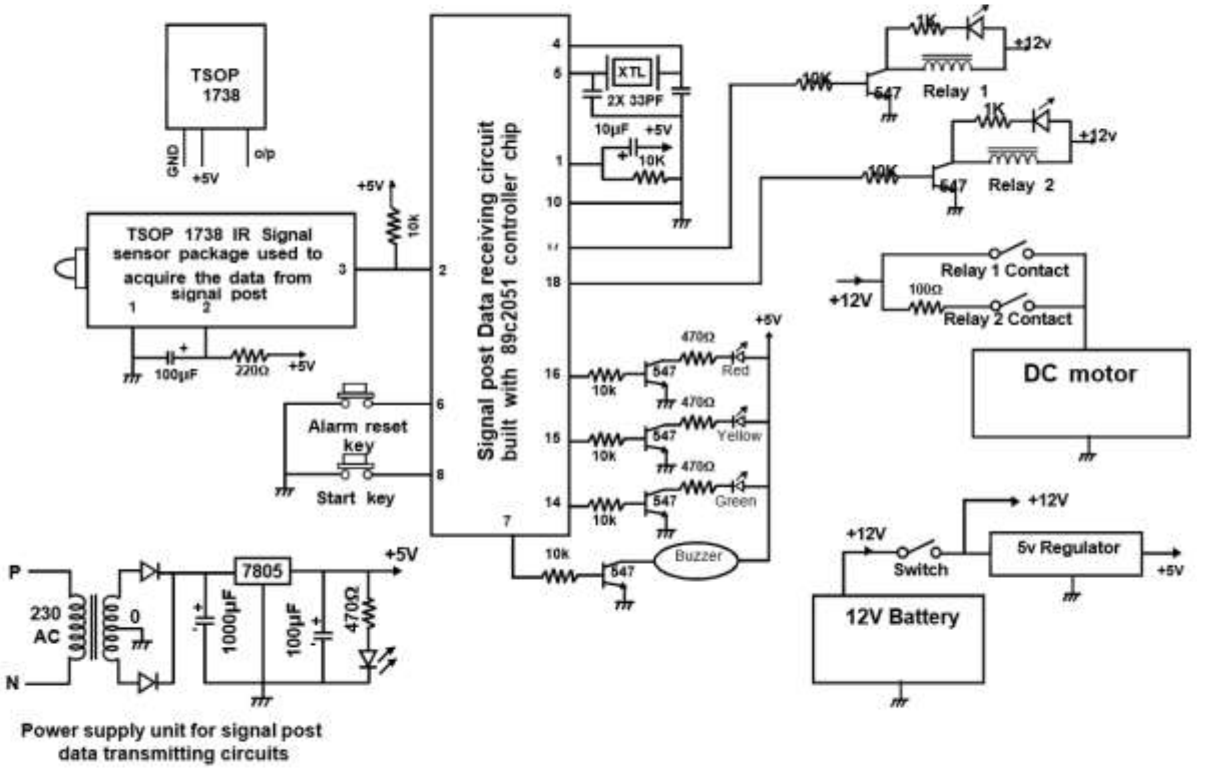

Figure 4. Driverless logic train with auto charging - Part - 2

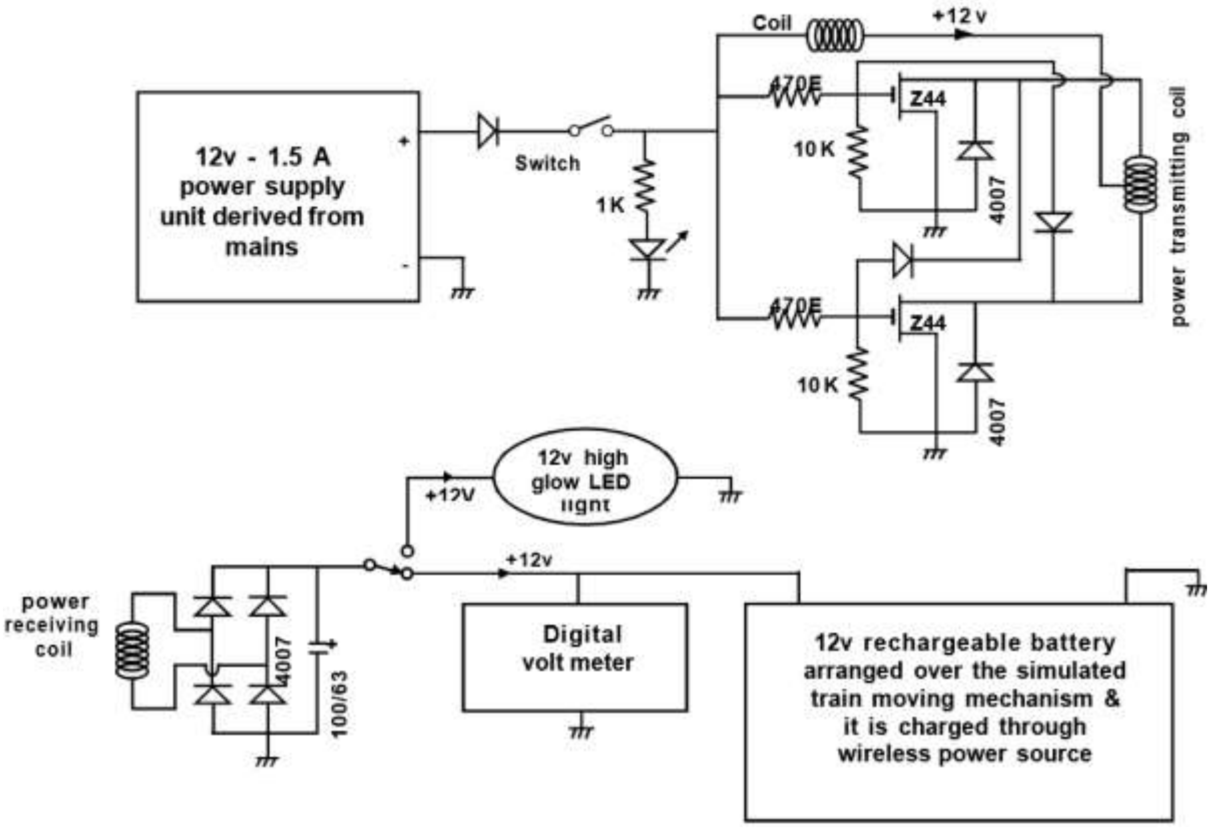

Figure 5. Driverless logic train with auto charging - Part - 3

The active components used in this project effort are listed below.

1 – 89C2051 controller chip
2 – Voltage regulator
3 – LM555 timer chip
4 – Buzzer
5 – TSOP1738
6 – Relay
7 – DC motor
8 – Z44 Mosfet

4.RESULTS

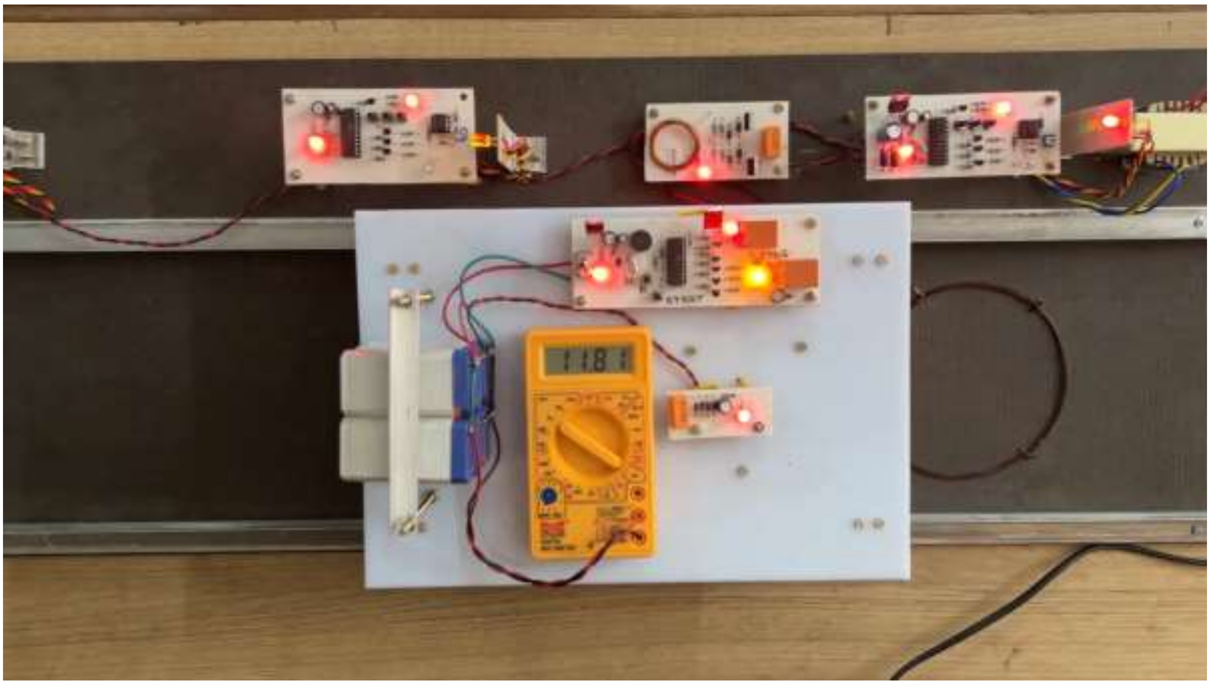

Figure 6. Hardware model of Driverless Logic Train with Auto Charging

CONCLUSIONS

The "driverless logic train with auto charging" project work has been successfully finished, and the outcomes are deemed acceptable. We discovered during our trail runs that it is quite difficult to relay data from the track side signal post since there are either no adequate sensors accessible or there are no circuits available[2]. In order to get the intended outcome, we conducted several trials using various circuits before designing our own circuit in this respect. The transmission of the digital data generated by the microcontroller chip is the circuit's ultimate objective.

Here, radio frequency communication is also advised. However, if signal posts are close to one another, there may be a serious risk of signal collisions, which might cause the system to show an incorrect signal. The intention is to transmit data as soon as the train approaches the signal post[3]. In this respect, we discovered that the data must be delivered in a single direction rather than in several directions as is the case with RF transmitters. For this reason, the circuit for an IR signal transmitter is built using an IC 555. Since it's a prototype module, the complete circuit, including the signal posts, is set up on a little wooden board that also has train track set up for a live demonstration. Because the complete system must be built together in this situation, short-range communication is chosen by feeding the LED that transmits the infrared signal with less current.

Lastly, a tiny wooden board is covered with a miniature train model and its track, together with the arrangement of signal lights, buzzers, sensors, control circuits, etc[5]. A mechanised moving mechanism is intended to run on the track since the idea is autonomous. In accordance with the signal data obtained from the trackside signal posts, this mechanism mechanically travels over the track. Thin wire is used to make interconnections once every gadget has been placed in its proper location. The circuit is now completely built in accordance with the circuit schematic, and a controller-appropriate programme has been created.

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