Automatic Wireless Mobile Charger Using Arduino Feedback

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Abstract: ***Wireless charging of gadgets is one of the new emerging technologies in the world at the moment. The most common method used at the moment is wireless power transfer by inductive coupling. . Wireless power transfer is one of the simplest and inexpensive ways of charging as it eliminate the use of conventional copper cables and current carrying wires. In this project write up, a methodology and principle of operation are devised for wireless power transfer through inductive coupling, and a feasible design is model accordingly. The inductive coupling technique is used since currently it's the easiest method of wireless power transfer because of high efficiency and large amount of the energy transferred. In the report paper, results of experiments done to check wireless working will be shown. Also to further show its versatility and range of applications the power transferred will be used to charge a battery with the aid of additional circuitry. We will also study the effect of placing hurdles between the transmitter and receiver so as to establish if it is an alternative in the medical industry for charging pace makers etc. This research work focuses on the study of wireless power transfer for the purpose of transferring energy at maximum efficiency within a small range or in the near field region using a Arduino feedback mechanism***

Index Terms**: *Mobile charger, Wireless, Arduino,***

I. INTRODUCTION

Remote Influence Technology [1], [2] is creating as a fitting response for offering imperativeness to diplomacies at remote partitions. This paper will focus on the innovation of inductively coupled [3], [4], [5] remote power trade. This gives an ensured, capable, and irreplaceable system for swap ability to remote static contraptions, or thought-provoking flexible devices. This twists around the rule of Full Striking Coupling (RMC), [6], [7] which can be accompanying with safe as houses most strange trade of force [8], contactless, thusly promising the individual to custody his electronic gadget capably..

Nikola Tesla a Serbian American analyst, a intuitive eventually of the year 1856, used high electric fields [9], [10] to trade massive events of essentialness by ionizing the air in the earth, which at last is a terrible spreader, to plasma. Semblance can be additionally be found in short-lived, where massive amount of essentialness is transmitted at higher frequencies is transmitted over a remote partition by ionization of the including the medium. Such events of imperativeness are of less use since they are non-supportable and are said harvest perilous electric fields. The encapsulation of the wonder of Inductive coupling stresses that by changing the engaging development between two inductive turns to exchange significance from the source to stack which is agree to Faraday "s Law of electromagnetic affirmation [11]. The structure working is in similarity to the working of a full transformer [12]. It joins an essential and optional contort, which is tuned to a particular rehash by a LC tank circuit.

II. METHODOLOGY

Because of the broad research in WPT, different classes have emerged. WPT can be classified as far as effectiveness, separation of transmission, control level and size. Arrangement dependent on separation of transmission anyway is more relevant .For any electromagnetic source both electric (E-fields) and appealing (H-fields) fields are made around it. These fields are depicted by the radiative and non-radiative parts. Dependent upon the partition from the source they can either be close field, change zone or far field. The change zone has properties of both the nearby and far field trades. he close field area can be said to be the found inside the scope of a wavelength while far field district is the domain outside a range of two wavelengths. This in any case is for transmitters and recipients that have breadths shorter than the wavelength being used. The nearby field trade

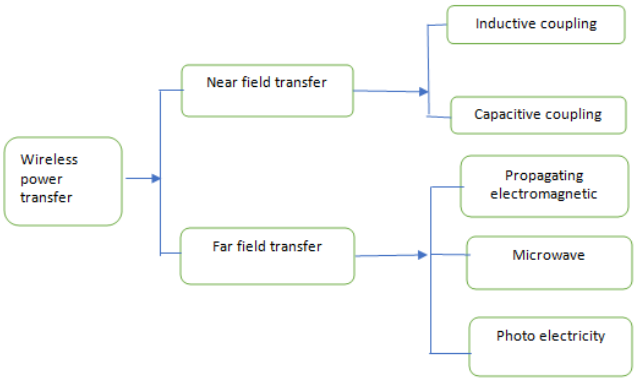

Fig 1: Overall Architecture

Have all the polarization types for example vertical, level, curved and round while the far field exchange just has one sort. This far in research the close field exchange has been found to have a higher productivity amid exchange of intensity. This can be credited to the diminishing in both electric and attractive fields relatively to the separation from the source.

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Likewise, the close field area permits higher diffraction of the wave, bringing about more grounded vulnerability and feeble directivity on a short range. In light of all these, more research is being center around advancement of the close field exchanges when contrasted with far field exchange.

Both near field transfer and far field are further categorized based on the method of operation of the transfer. Some of the methods are as follows:

Block diagram of my project which will work in systematic manner one after another by checking every time condition through the Arduino feedback mechanism and it will pass the command to required circuit

Design and assemble a power supply unit. The power source was to step down 230V ac abounding by the mains to 12V ac in height occurrence. The 12V ac was then to be remedied to give 5V dc.

Supply Step the dc. Using a boost converter, the dc voltage was raised to 30V dc

Design and assemble fitting oscillator. For the project, oscillator was create be furthermost right.

After assembling and fabricating the components on the bread board. The above three objectives formed the Transmitter module. When assembled and fabricated it was as depicted in the figure below.

III. Outline of the Project

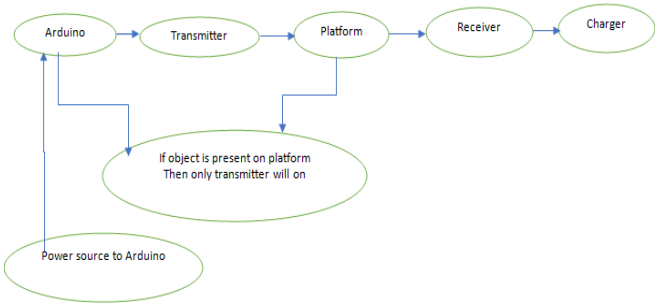


Fig 2: Overall outline of the Circuit

Now we have broken the components of my project and explain all the module of the project as following

1. **Inductance design**
2. **Transmitter**
3. **Receiver**
4. **Platform**
5. **Charger**

Inductance design

A single layer coil, "as shown in figure, has two advantages. Firstly, like all air core coils, it is free from iron losses and the" non-linearity mentioned above. "Secondly, single layer coils have the additional advantage of low self-capacitance and thus high self-resonant" frequency.

In the simple case of a single layer solenoidal coil the inductance may be calculated as follows:

L = (d2n2) / (l + 0.45d) [µH]

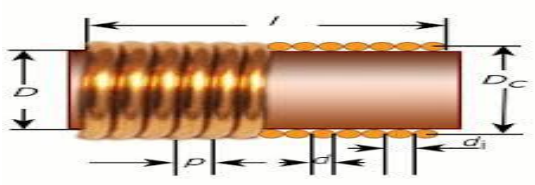
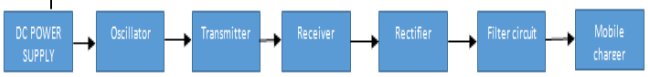


Fig 3: Inductor

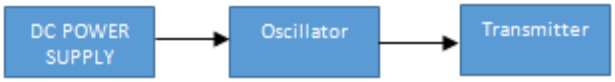
Transmitter Circuit



The transmitter module of our project is made up of a D.C. power source, an oscillator circuit (as an inverter) and a transmitter coil. The D.C. power source provides a constant D.C. voltage to the input of the oscillator circuit. There, this D.C. power is converted to a high frequency A.C. power and is supplied to the transmitter coil . The transmitter coil, energized by the high frequency A.C. current, produces an alternating magnetic field.

Oscillator Circuit:

The prototype oscillator Circuit designed for the project is a modified Royer oscillator. This oscillator circuit is incredibly simple yet a very powerful design. Very high oscillating current can be achieved with this circuit depending on the semiconductor used . Here high current is necessary to increase the strength of the magnetic field.



Formula to calculate the frequency of the circuit

F= 1/2 × π × √ (LC)

$$L = \frac{n^2 * \mu_0 * a}{l}$$

L = inductance in hennery
n = no of turns
μ_0 = permeability of free space
l = length of winding
a = cross section of coil

Transmitter coil:

For designing the transmitter and receiver coil
92mm diameter
17swg copper coil
7 turns
From above formula we got inductance = **8.1uH**

Receiver:

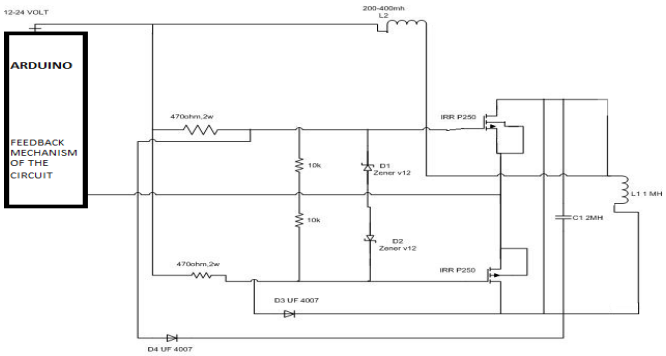
The receiver module of our project is made up of a receiver coil, a rectifier circuit and a voltage regulator IC. And additional buck converter to get more current by decreasing output voltage to 5 volt.

An A.C. voltage is induced in the receiver coil . The rectifier circuit converts it to D.C. and the voltage regulator IC helps to maintain a constant limited voltage at the load

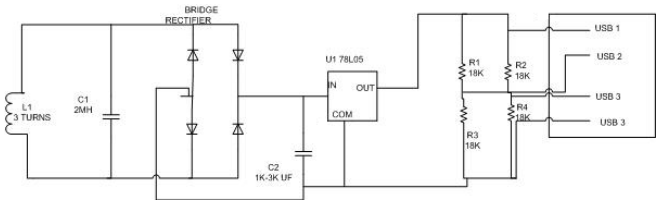
IV. CIRCUIT DESIGN AND IMPLEMENTATION

Our preliminary affirmation of the endeavour contains three twists that are tuned at a comparable repeat. An influencing circuit is related with a source twist Circle is coupled full inductively to a transitional twist Q which is coupled reverberating inductively to a store passing on twist R. The twists are contained an electrically driving copper wire of cross-sectional range r. Right when a radio repeat faltering sign is experienced the circle S, it delivers an influencing appealing field, inverse to the twist . The widely appealing twist Q is set near the circle S, which is tuned at a comparative repeat through the inductance of the circle and a resonating capacitor C1. The circle Q being in the zone of the appealing field delivered by twist S, gains power. Not having any resistive weight, the circle accordingly makes its own one of a kind influencing alluring field. The upside of using this twist is that it is completely segregated from the source inside obstacle. This fabricates the Q-factor, empowering progressively significant ability to be exuded. By the day's end, the circle Q transforms into the wellspring of the system. The store circle R, tuned at the proportional full repeat, gets the power through the alluring field created by the widely appealing twist Q. The indistinguishable circuit diagram of power trade exhibit is given in figure-5. The power trade occurs from circle S to twist R. The influence hardship in circle Q is slighted here, since the twist Q has an incredibly little deterrent.

TRANSMITTER CIRCUIT



Receiver Circuit:



V. RESULTS AND DISCUSSION

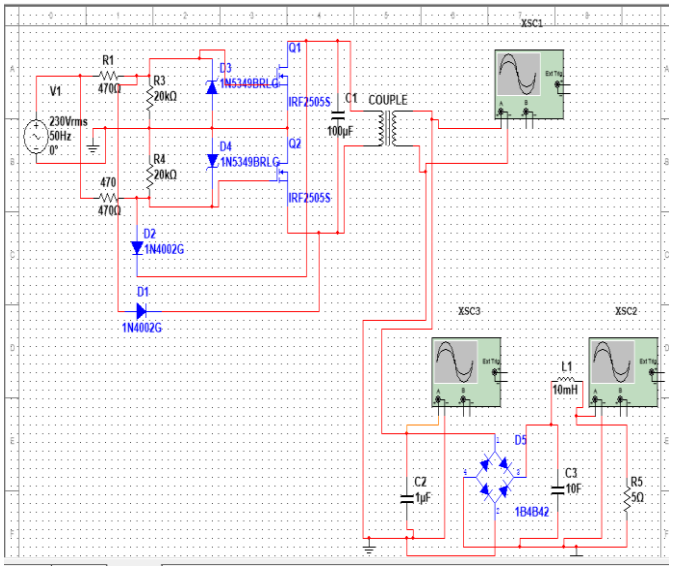


Fig : Simulation circuit in Multisim software

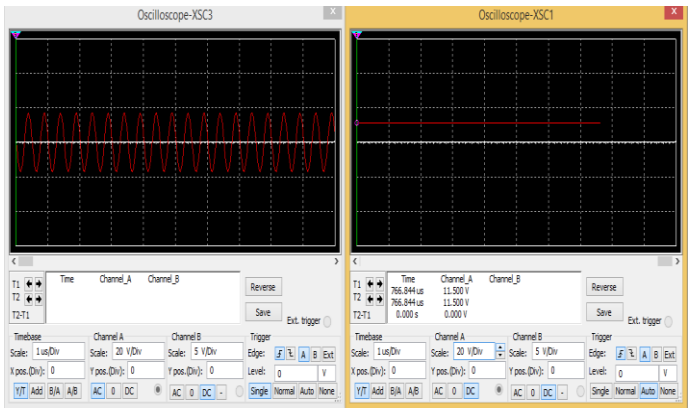
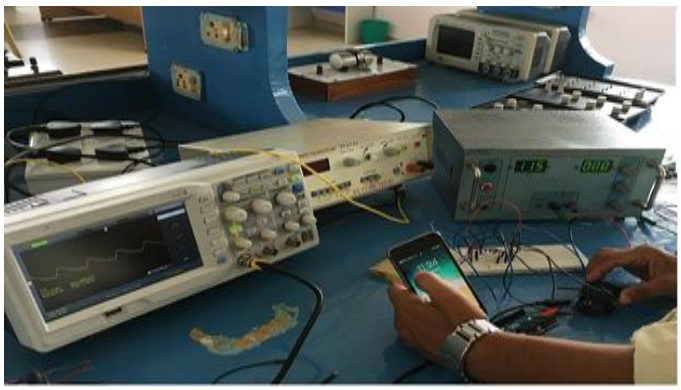


Fig : Voltage and current in DSO

Develop transmitter and receiver coils: Electromagnetic induction befalls between these two twists and an emf created on the TX coil that encourages a current on the RX coil. The coils were rooted on the untrue external of the components. However they are as in the character below.

HARWARE IMPLEMENTATION



Design the receiver module and rectify the ac voltage received on the receiver coil.

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For a rectifier was required to output dc power which would be cast-off to power other gadgets

Analysis and Discussion

Coils:
To test if control was transmitted we initially connected a LED to the handset loop. The test was sure with just 5V dc fuel the oscillator. Anyway the power was too to empower the battery charging circuit that included a LCD and chip. The voltage was ventured up utilizing a lift converter to 30V dc. Two accepting curls were utilized and each had a LED light. They both lit brilliantly. We at that point included a lot of LEDs and the outcomes were as in the figures below. In the above figure, the getting loops were not withdrawn from the source curl. Anyway as the unit of separating expanded the outline. This demonstrated to be sure the separation of division decides the current prompted in the recipient curl. As separation increments, less current is impacted from the difference in motion. The test LED knobs lit liveliest up to a take off separation of 5cm in the midst of the two loops after which their lighting diminished significantly. Also, irrelevant sizes of the curl were utilized to administer which was increasingly usable. At present in the sooq the most joint are measure 26 and check 16. It was noticed that for the curls of gaug16, the separation of leave-taking between the loops must be nearly nothing and furthermore the glare of the bulb was not exactly for the measure 26.Several things were set among the headset and the spreader curl to test if the protecting would affect the power being coordinated. It was seen this didn't have any striking impact on the power that was transmitted. Anyway when an appealing physical was placed in the middle of the loops it had an impact

Oscillator:
The royer oscillator was picked as a result of its straightforwardness yet amazing plan. It is equipped for creating in tallness faltering current which is required to build the quality of the charming field. This is accomplished by the semi-conductor utilized. For this situation, the IR 540 power mosfet . Anyway because of the expansive current, warming happened in the MOSFETs hence heat sinks were joined to them. When the voltage was ventured up to 30V dc, after doing the underlying test the transmitter circuit didn't waver yet the first MOSFET was quickly warming up. It was found that due to voltage being sustained rising too gradually on catalyst a short out happened. To tackle this issue, areset switch was presented between the power supply and the oscillator circuit. The switch likewise empowered the circuit to be reset once the MOSFETs warmed up

APPLICATIONS

1. Uses in stationary High Altitude Relay Platform (SHARP)
2. Charging of electric vehicles
3. Electronic convenient gadgets

ADVANTAGES

1. Safe for human, basic execution
2. Charging numerous gadgets at the same time on various power, high charging effectiveness
3. It expands ease of use as the issue from interfacing links is banned. Diverse makes and distinguishing models of apparatuses can likewise utilize a parallel charger.
4. It upgrades adaptability, particularly for the gadgets for which supplanting their series or interfacing links for charging is exorbitant, dangerous, or infeasible (for example body-embedded sensors).
5. It concentrates the building and creation of a lot littler contraptions without the linking of sets.
6. It gives better item solidness (e.g., waterproof and dustproof) for without contact gadgets.

Results
A tests has been led to get the WPT efficacy. The program inductive connection was fashioned with extent 4.5 cm number of turn is 20 while the addressee applying amount 4.5 cm number of turn is 20.The departure among these two inductive loops are shifted to acquire the ideal departure for remote power program.

HARDWARE SIMULATION RESULT

distance (in cm)	voltage (volts)
0	10.1
1	9.8
1.5	8.3
2	7.5
2.5	7.1
3	6.9
3.5	6.1
4	5.7
5	4.95

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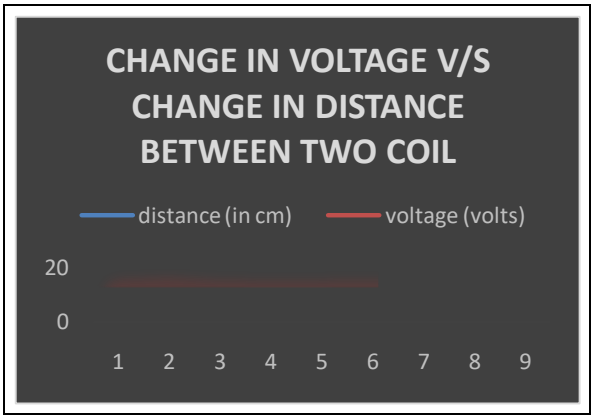

The main unbiased of the scheme was to progress a expedient for wireless power transfer. The expedient had to be an electric circuit. The accomplishment of this apart was further fragmented down into specific purposes which all calm aided the progress of the device.

The other aims were as follows:
After assembling and fabricating the components on the bread board. The above three objectives formed the transmitter module. When assembled and fabricated it was as depicted in the figure below.

VI. CONCLUSION

The purposes of the development were met. An electrical device that wirelessly conveys power and then custodies batteries was developed. We were able to design discrete components such as the royer oscillator, coils and a full bridge voltage rectifier for the system design process. Suppositions that were strained from the plan study are as surveys:

1. Based on the theory of wireless charging via inductive coupling, which was the method used in the project, it was seen that various aspects i.e. distance, resonant frequency, quality factor; coil turns ratio determine the efficiency of WPT. In addition there is an exponential decay for power versus the distance of separation.

2. From the analysis it was seen that at 0cm separation distance, the power transfer was most efficient as seen by the brilliance of the test lamps.

3. From the project WPT for short series or near field occurred up to a distance of 5cm after which the power relocated began to knowingly drop.

4. It canister also be determined that WPT can be used in other plans. In the project we were able to custody a 9V battery from power that was communicated wirelessly.

The idea of charging a phone battery utilizing remote RF vitality gathering can be achievable. While voltage crosswise over yield is alluring yet yield current is tranquil lower demonstrating that battery or cell phone will involve ample time to charge. Remote low power program framework would totally take out conveying chargers for cell phones or tabloids.

FUTURE SCOPE

1. Wireless Charger Network: - Comparable to wireless statement systems that afford data service, a wireless pony network can be built to transport energy provisioning service to scattered users. The wireless charger network that attaches a collection of circulated chargers through wired or wireless links allows to conversation statistics (e.g., include availability, setting, alleging status, and cost of different chargers) to schedule the chargers.
Currently, how to perform green wireless energy provisioning remains an open issue and has been ignored by the majority of existing studies. One promising solution is to equip renewable energy sources, e.g., solar, for wireless chargers.
- The upsurge of wireless accusing power density gives rise to more than a few practical issues, e.g., thermal, electromagnetic compatibility, and electromagnetic field difficulties [16]. This requires high-efficiency power adaptation techniques to reduce the power loss at an dynamism earpiece and battery modules with actual ventilation design.

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