WIRELESS POWER TRANSFER SYSTEM

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***Abstract* — The main aim of this project is controlling the transfer of power wirelessly. LCD and keypad acts as I/O devices interfaced to the microcontroller. Relay based switching circuit is used to control the access for the wireless charging, hence saving power when not in use. Additionally, for security and authentic process, user is provided with a unique identification number which he utilizes for working of this whole project.**

***Index Terms* — authentic, microcontroller, interfaced**

I. INTRODUCTION

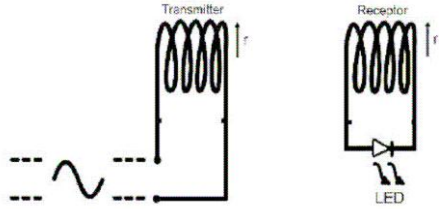
One of the major issue in power system is the losses occurs during the transmission and distribution of electrical power. As the demand increases day by day, the power generation increases and the power loss is also increased. The major amount of power loss occurs during transmission and distribution. The percentage of loss of power during transmission and distribution is approximated as 26%.

The main reason for power loss during transmission and distribution is the resistance of wires used for grid. The efficiency of power transmission can be improved to certain level by using high strength composite over head conductors and underground cables that use high temperature super conductor. But, the transmission is still in efficient [1]. Hence, to improvise we needed the principle of wireless transfer of power.

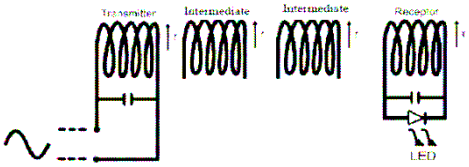
The technology and theory behind wireless transmission exist around for a long time – the idea was initially suggested by Nikola Tesla, who demonstrated the principle of wireless charging at the turn of the century [2]. His works also enlightened the idea that when the AC current flows from primary coil, certain amount of EMF is induced in secondary coil due to magnetic flux. This gives rise to flow of current in the secondary circuit.

II. WIRELESS POWER TRANSFER

The basic concept behind electromagnetic approach of WPT is magnetic induction between two coil say transmitting and receiving coil. When transmitter coil is excited then it generates flux and when receiver coil receives this flux a potential difference is developed across its terminals. The potential difference developed in receivers is directly related to distance between transmitter and receiver coil [3].



But this method is only for short distance transmission and has poor efficiency. For greater efficiency we need inductive coupling with many intermediate coils between transmitter and receiver.



III. BASIC WORKING PRINCIPLE

The Circuit is designed to control the transfer of power wirelessly. Basically input supply is provided on primary side. Since we require DC current, we use a rectifier. A rectifier is an electrical device which converts bidirectional AC current to unidirectional DC current. This current is made to pass through transistors and then to the primary coil windings. This current produces a magnetic field around the windings. Voltage regulators are used to maintain constant voltage level. Converse effect is observed on the secondary side. When this magnetic field is observed, certain amount of potential difference is induced and this is the reason why the current starts flowing. Again the current is converted back to AC with power inverter and is regulated so that we can use it for our appliances and devices[11]. Unique number is being inserted by user for authenticity and then asked for amount of time the charging of the device required. Once the time is over, charging stops.

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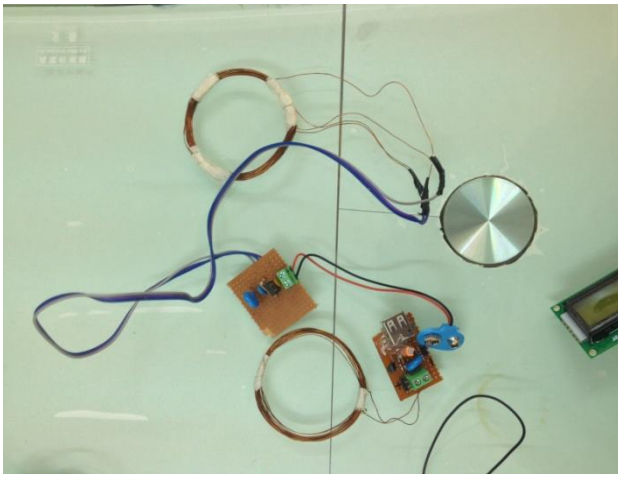
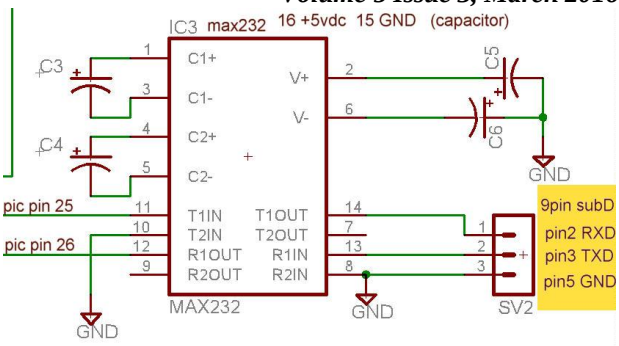
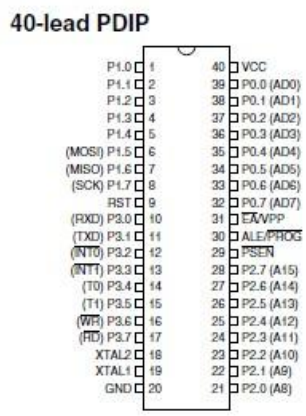




IV. PROPOSED METHOD

A. Microcontroller AT89S51

The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of In-System Programmable Flash memory. The device is manufactured high-density non volatile memory technology and is compatible with the industry- standard 80C51 instruction set.



The AT89S51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters, a five-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry [4].

B. Max232

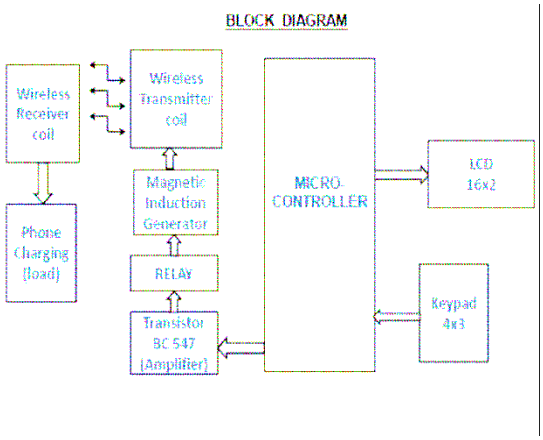
Its a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide TIA-232 voltage level outputs (approx. ± 7.5 volts) from a single five volt supply via on-chip charge pumps and external capacitors. This makes it useful for implementing TIA-232 in devices that otherwise do not need any other voltages .The receivers reduce TIA-232 inputs, which may be as high as ± 25 volts, to standard five volt TTL levels. These receivers have a typical threshold of 1.3 volts and a typical hysteresis of 0.5 volts.

C. Keypad

We use a numeric keypad as an I/O device which would help us assigning the required values which would be displayed on the LCD.

V. PROPOSED METHOD WORKING PRINCIPLE

Here, we arrange all the equipments as shown in the block diagram. Place two magnetic coil windings nearby each other, in the same field for mutual induction. On the secondary side, we also have an inverter to convert AC to DC so that the load (any electrical device for ex. Mobile phones) is provided with the required power.



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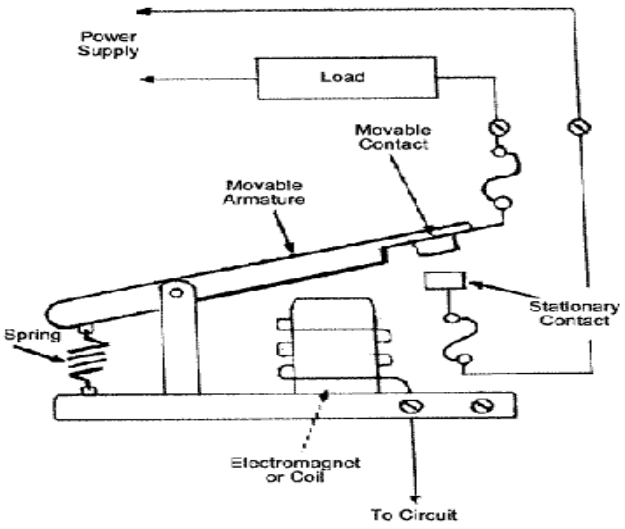
On the primary side, we have a primary coil whom we supply AC from the input power supply. Since the supply is DC, we first convert it to AC by using a rectifier.

Simultaneously, the microcontroller AT89S51 is interfaced with keypad as input device and LCD display as output device. Now as per conventional system, once the supply is given, the whole equipment starts working and magnetic field is produced which induces voltage and the wireless transmission occurs. This phenomenon would continue to occur until the supply is given. But if we don't switch off the supply and there are no devices in the field which need power, then a considerable amount of power and energy would be wasted which is a major disadvantage. Hence to overcome this setback we use microcontroller.

For wireless mobile charging through this concept, the user could enter a scratch card number allotted to him. This would be a unique identification number of the user, which he can enter using the keypad provided. The LCD display would be displaying it and would ask for further details.

The core of this concept lies in the usage of the relay. A relay consists of two separate and completely independent circuits.



The first is at the bottom and drives the electromagnet. In this circuit, a switch is controlling power to the electromagnet. When the switch is on, the electromagnet is on, and it attracts the armature. The armature is acting as a switch in the second circuit. When the electromagnet is energized, the armature completes the circuit. When the electromagnet is not energized, the spring pulls up the armature away and the circuit is incomplete [5].

The microcontroller is interfaced along with the Max232 in such way that every user has to enter a unique number and that unique number will help the user to access the power for certain allotted time duration. The timer that we have used signifies the amount of time left for charging.

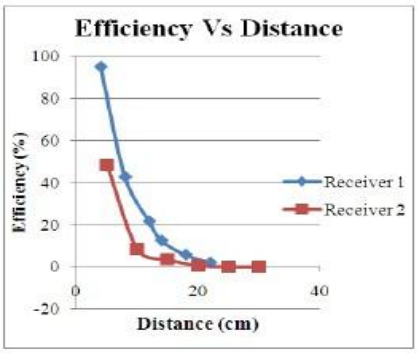
For accuracy, a buzzer is used so as to indicate that the charging has begun. Another round of buzzing occurs few seconds before the time is up. Once the allotted time is over, the arm of the relay is pulled over and the circuit is broken, thereby preventing any further loss of energy. Additionally, provision for charging not only one but many devices simultaneously is also available.

VI. RESULT

The project's result can be divided into two major parts i.e. efficiency and power transfer. For comparison we consider another receiver coil at few centimeters away from the first receiver. For convenience and graphical purpose we label them as Receiver 2 and Receiver 1 respectively.

The following graph reveals the result that the efficiency goes on decreasing as the distance goes on increasing.[10] This is because the transmission occurs through the medium of air, wherein losses like multipath propagation are bound to occur.

The formula for efficiency percentage calculation is, $\eta = (Pout/Pin) * 100$



The graph given below is of power vs. distance which indicates that as the distance is increased, the power transmission decreases. The formula for power calculation is P = VI [10].

Besides that, we observe that the circuit is only functional until the microcontroller is asked for. As soon as the use of the circuit is over, the connection is broken and further transmission is terminated. It is only resumed after the user asks it to do so.

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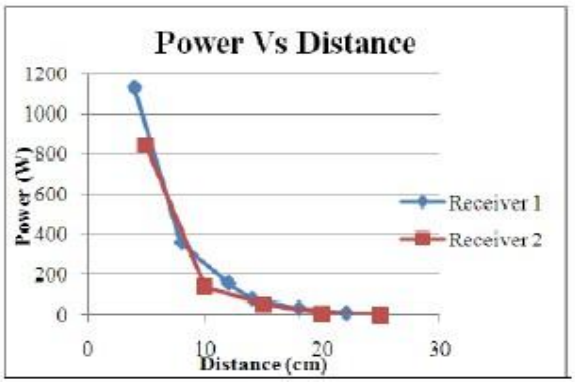

Apart from this, we can conclude that if the user enters any other vague number or enters the same number once used then the LCD would display the number entered is invalid and the charging won't occur, thereby providing security.

VII. ADVANTAGES AND MERITS

- The most important advantage of this project would be authenticated use of power. With the help of microcontroller, the use of the device for transformation could be controlled and interfaced by the user as per his needs.
- Due to interfacing, the user would be able to limit the wastage of power when it is not required by the device.
- High Transmission Integrity and Low Loss: - To transmits wireless power to any distance without limit. It makes no difference what the distance is. The efficiency of the transmission can be as high as 96 or 97 per cent, and there are practically no losses [6][7].
- The power could be transmitted to the places where the wired transmission is not possible. Loss of transmission is negligible level in the Wireless Power Transmission; therefore, the efficiency of this method is very much higher than the wired transmission [8].
- Wireless Power Transmission system would completely eliminates the existing high- tension power transmission line cables, towers and sub stations between the generating station and consumers and facilitates the interconnection of electrical generation plants on a global scale [8].

VIII. APPLICATIONS

1) ***Mobility*****:** Since the whole arrangement is pretty compact, it is possible to make it portable. For example, it could be fitted into a car and one could easily charge his mobile phones for the required time without wastage of power.

2) ***Transportation:*** Automatic wireless charging for existing electric vehicle classes: golf carts, industrial vehicles. Automatic wireless charging for future hybrid and all electric passenger and commercial vehicles, at home, in parking garages, at fleet depots, and at remote kiosks [9].

3) ***Industrial:*** Direct wireless power and communication interconnections across rotating and moving joints (robots, packaging machinery, assembly machinery, machine tools) eliminating costly and failure prone wiring. Besides that, power transmission could be feasible in harsh environment like construction sites, where long wires with heavy electric supply would only increase the complexity. Direct wireless power for wireless sensors and actuators, eliminating the need for expensive power wiring or battery replacement and disposal [9].

IX. CONCLUSION

In this research, we studied various aspects of wireless power transfer and also understood a new concept by which one could easily charge his mobile batteries without wasting units of power. Practically, one reduces the usage of long and bulky wires. Moreover, we learnt that power transmission could be made authentic to the user. The microcontroller plays a vital role and takes the technology to a new level.

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