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Semi-Automated Electric Automobile Charger Testing Platform

Santhosh T[1], Muthukumar K[2]

[1]*PG Student, Industrial Safety Engineering, Bannari Amman Institute of Technology, Tamil Nadu, India*
[2]*Professor, Industrial Safety Engineering, Bannari Amman Institute of Technology, Tamil Nadu, India*

Abstract*: This paper presents a semi-automated electric automobile charger trying out platform the use of Arduino mega 2560 microcontroller board which can be used as a trying out platform to check the functioning and reliability of electric vehicle chargers synthetic in electric powered vehicle manufacturing industries. Repetitive electricity On Off take a look at and Line regulation test and Load current test can be performed using the proposed testing platform in different load circumstance. This approach includes a SD card primarily based information logging machine to file the real time check statistics along with input voltage and current and output voltage modern-day. The proposed system additionally offers a programmable steady modern-day load setup in order that the checks may be completed in any load conditions. The regular modern-day load setup is mainly primarily based on controlling the gate voltage of a MOSFET operating in saturation or active mode of operation. The consequences of different take a look at situations are supplied.*

Key Words: **Tap changing transformer, Relay, Testing, SPI, SD card.**

1. INTRODUCTION

Product Testing is one of the crucial processes in production of a product. The nice and performance of a product in opposition to actual time running situations is checked at the same time as checking out with the aid of creating anticipated load conditions and different up ordinary conditions such as voltage spikes and frequency variations artificially. This venture describes a semi-automatic device for the testing of electric vehicle battery charger manufactured in electric automobile industries using Arduino mega 2560 microcontroller. By using this, reliability of the charger may be checked with minimal manpower. This device may be applied in electric automobile charger production industries wherein larger range of chargers must be tested for the performance, reliability and quality. . Once the charger exceeded all of the checks then it'll be supplied to the customers for real time use.

In this work a semi-automatic charger checking out setup is provided the use of Arduino mega 2560 microcontroller. The system incorporates input and output devices inclusive of keyboard and liquid crystal display (LCD) 16*2 for actual time user interfacing motive. The specific test packages and extraordinary take a look at situations can be given as an enter through the consumer through keypad interfaced with the microcontroller. A 2KVA Tap converting transformer is used to get numerous AC voltage degree shape 0-four hundred volts AC form the constant 230 volt 50 hertz single section AC grid supply if you want to behavior load law check. Depends at the consumer input, the voltage required for the test situation may be selected by controlling the relay connected to the faucets of the multi tap transformer the usage of Arduino. In this way input side of the charger is provided with diverse AC voltages required for the take a look at circumstance.

The output side of the charger is hooked up to a programmable steady cutting-edge load [2] .The load current required for the check circumstance can be set through the keypad with the aid of the person. In this regular cutting-edge load circuit Power MOSFET is used to get the weight present day by means of controlling the gate voltage of the MOSFET via an Operational amplifier circuit which is running in open loop differential amplifier configuration [1].

By the usage of the proposed system repetitive on off check, line law check, load regulation tests can be carried out in actual time. Temperature version test may be carried out by using including a suitable benchtop programmable temperature chamber with the proposed setup. The check records can be obtained through the SD card interfaced with the Arduino microcontroller via SPI communication protocol. Figure 1 indicates block diagram of the complete test setup proposed in this paper. The input and output parameters of the electrical automobile charger are measured, displayed and stored the use of appropriate sensors interfaced with the Arduino microcontroller.

2. BLOCK DIAGRAM

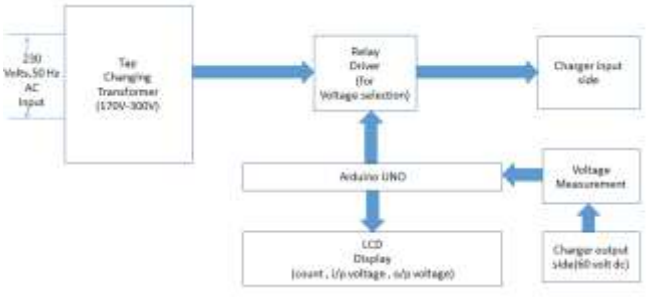

Fig-1: Block diagram of hardware system

3. DESIGN

A. Multi Tap Transformer

In this 2KVA single phase Multi tap transformer is used get different AC voltages required for the test conditions from a 230 volt 50 hertz mains supply. Primary side of the

transformer is supplied with 230 volt 50 hertz single phase AC supply. Secondary side has 13 taps which are capable of supplying 100 to 400 volts single phase AC voltage in 25 volts difference for each consecutive tap.

B. Relays

In this work electromechanical business grade socket mounting 12 Volt DC relays are used to exchange between special taps of the multi faucet transformer. Rated working voltage of the relay contacts are 230 volt AC at 8 Amps. According to the records sheet these relays are capable of switching up to 440 volt AC [5].

The relays are related in such a way that generally closed Terminal of a Relay is connected to the common terminal of next relay. This ensures that during any situation faucets of the multi faucet transformer will now not be brief circuited. ULN 2003A is a low aspect load driver IC which has 7 parallel enter and output channels in order that it can pressure seven exceptional loads at identical time It also has inner fly returned diode to drive inductive hundreds along with motors and electromechanical relays. The inputs are well suited with various varieties of logic consisting of TTL and CMOS.

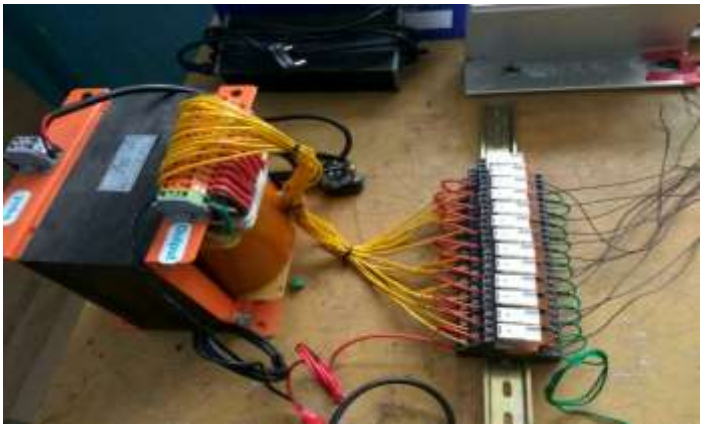

Fig-2: Tap converting transformer connected with relays.

C. Relay interfacing circuit

Fig-3: Relay interface circuit board

The relays are interfaced with Arduino mega microcontroller board through Relay motive force IC ULN2003A [7]. These are excessive-voltage, high-current Darlington transistor arrays. It consists of seven NPN Darlington pairs that function excessive-voltage outputs with commonplace-cathode clamp diodes for switching inductive loads consisting of cars and electromechanical relays. Each channel is capable of driving up to 500 mA cutting-edge at a most voltage of fifty volts DC. The inputs are compatible with various styles of logic which include TTL and CMOS. A printed circuit board (PCB) is designed and implemented for interfacing the relays with microcontroller at the side of led indication to perceive the relay switched. For every relay there's a led to expose the circumstance of relay..

D. Constant current load

In order to check the electric automobile chargers underneath numerous load conditions a programmable consistent modern-day load circuit is designed using IRFB4321, LM324 OP-AMP and MCP41010 Programmable virtual potentiometer. Current in the load circuit is managed by way of various the gate voltage of the MOSFET that's working in saturation or active mode of operation. In linear mode, the MOSFET is on no longer fully however partly, behaving like a variable resistor. It is Possible to manipulate the drain present day, ID in a linear style by way of controlling the gate supply voltage VGS. Figure 4 shows the proteus simulation of adjustable constant cutting-edge load. LM324 Operational amplifier which is utilized in open loop differential amplifier configuration generates the gate voltage required to control the burden modern-day. The voltage across the shunt resistor is carried out to the inverting terminal of the Operational amplifier.

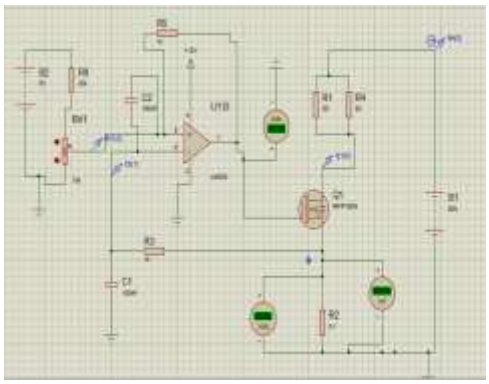

Fig-4: Constant current load circuit

The reference voltage that is non inverting terminal of the op-amp is hooked up to the output of MCP41010 digital potentiometer and the real modern-day is sensed through the shunt resistor [4]. The differential amplifier amplifies the small difference among the reference and the actual voltage throughout the shunt resistor. By using this setup the drain modern-day, can be set to a favored value absolutely with the aid of adjusting the MOSFET gate voltage. The price of drain contemporary does now not depend on the terminal voltage i.E. VDS of the loaded tool, this is the electric vehicle

charger. Two 30 ohm dynamic braking resistor are used as parallel to dissipate the electricity.

These two resistors are capable of dissipating 550 watts of electricity. In order to cool these excessive electricity resistors a table fan is used for pressured air cooling. This manner the device beneath check is loaded with the steady modern-day set via the consumer that passes through the shunt resistor and the burden current can be kept constant over more than a few time various terminal voltages. Figure shows the simulation diagram of constant contemporary load and PCB is designed and applied in real time also shown within the design.

E. voltage and current measurement

The enter and output parameters including input AC current and voltage, output DC voltage and DC current are measured the use of the analogue input pins of Arduino mega microcontroller by using appropriate circuits and require sensors. The input ac voltage is measured by using using a capacity transformer and voltage divider circuit and a diode to reduce off the negative cycle of the AC voltage, due to the fact analog pins of the microcontroller simplest the high-quality voltage. The output DC voltage is measured the usage of a voltage divider circuit constructed with the help of resistors. This voltage divider circuit converts high DC voltage into less than five Volt DC because the controller only accepts less than or identical to 5 volt DC. Both the currents this is enter AC and outputs DC cutting-edge are measured using ACS712 20 Amps Hall Effect based remote modern-day sensor. The sensor is able to measuring as much as 20Amps AC in addition to DC currents. For AC current measurement programs the sensor has an offset voltage of 2.Five volts. The sensor, which has a sensitivity of 100milli volts per ampere.

4. IMPLEMENTATION

The entire machine is applied the usage of Arduino mega microcontroller board in conjunction with input, output devices and take a look at setup. The float chart of the test setup software is shown in discern. The input parameters such test voltage, on time, off time and range of counts are acquired from the Person through four*3 matrix keypad. A sixteen*2 Liquid crystal display (LCD) is used for showing the input output parameters such voltage and contemporary. While jogging the actual time testing the parameters together with input voltage, present day and output voltageand current are stored in an SD card which is interfaced with Arduino mega microcontroller through serial peripheral interface. If there is any error in the measured parameters then the test program will stop execution and indicates and error through LCD display.

Fig-5: shows the complete testing setup

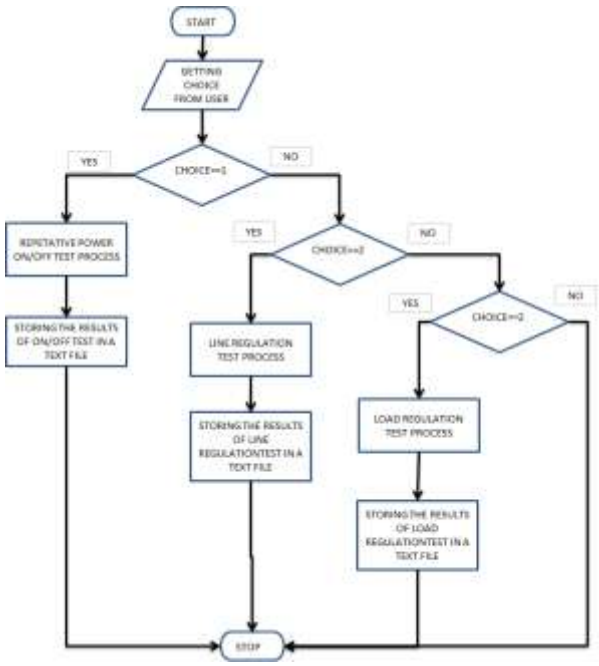

Fig-6: Flow chart of testing program

Fig 6 indicates the glide chart of the testing software written into the Arduino mega microcontroller. The program gets selections from user thru the matrix keyboard interfaced with the microcontroller and indicates the statistics through the 16*2 LCD interfaced with the microcontroller. According to the user enter the check setup switches the relays connected to the multi tap transformer. The load contemporary controlled by using the programmable constant current load circuit designed and carried out the use of the MOSFET and Op amp LM324N.

5. CONCLUSION

Through this paper we proposed a low fee semi-automated electric powered automobile charger trying out platform which might be used to check the capability and reliability of electric vehicle chargers synthetic in electric vehicle industries against actual time voltage fluctuations and numerous environmental conditions. The device also incorporates a SD card based totally records logging machine to shop the take a look at parameters inclusive of voltage and

currents as text report. This text document can in imported right into a excel sheet as a way to view the check records as a pictorial illustration. The capability of the charger can be checked for the graph received from the statistics saved inside the text file.

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