Charging Stations for Electric Vehicles

Project Exhibition -1

Submitted in partial fulfilment for the award of the degree of

Bachelor of Technology
In
ELECTRICAL AND ELECTRONICS ENGINEERING

Submitted to

VIT BHOPAL UNIVERSITY (M.P.)

Submitted by:

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MAY - 2021

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CANDIDATE'S DECLARATION

I hereby declare that the Dissertation entitled "CHARGING STATIONS FOR ELECTRIC VEHICLES" is my own work conducted under the supervision of Dr. Om Prakash Pahari, Assistant Professor, Electrical and electronics department at VIT University, Bhopal.

I further declare that to the best of my knowledge this report does not contain any part of work that has been submitted for the award of any degree either in this university or in other university / Deemed University without proper citation.

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

Date: 08 May 2021

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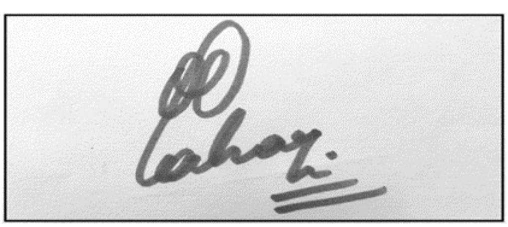

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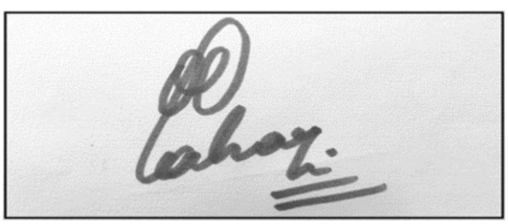
CERTIFICATE

This is to certify that the work embodied in this Project Exhibition -1 report entitled **"CHARGING STATIONS FOR ELECTRIC VEHICLES"** has been satisfactorily completed by **Ms. RADHIKA GURJAR** Registration no: **19BEE10027**in the School of Electrical & Electronics Engineering VIT University, Bhopal. This work is a Bonafide piece of work, carried out under my/our guidance in the School of Electrical and Electronics Engineering for the partial fulfilment of the degree of Bachelor of Technology.



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Acknowledgement

First and foremost, I would like to express my deep and sincere gratitude to my guide, Prof. Om Prakash Pahari, Assistant professor, SEEE, VIT Bhopal University, and our program chair Dr.Pallabi Sarkar Asst. Professor, SEEE, VIT Bhopal University for offering me the opportunity execute this project. Under their guidance and experience, I learned a lot about the various aspects in and around the project. They supported whenever needed, even during their busy schedule. It was indeed a privilege to work under these qualified visionaries.

I would like the extend my heartfelt thanks to the panel members Prof.Pallabi Sarkar, Prof. Susant Panigrahi, Prof. Jitendra Kumar Tandekar, VIT Bhopal University, for his timely suggestions and ideas to direct us into the right path towards success and to the completion of the project.

I am overwhelmed and grateful for the support and competition given by my fellow classmates.

I would like to give credit to my teammates Deepshikha Sen(19BEE10029), Anuradha Tiwari(19BEE10030), Nilesh (19BEE10026). It is because of their cooperation for the project, stimulation in the discussions, contribution with each of our ideas and effort, we were able to bring forth our project to reality.

EXECUTIVE SUMMARY

The on-going technical development of charging technology by EV manufacturers has taken many varied courses to date, reacting to early research and product innovations. The management of charging networks is still in its infancy and a continued investment in quick charging infrastructure is needed in order to overcome some of the barriers to the introduction of EVs. Continuing developments in technology and competition in the marketplace are however likely to result in multiple types of charging infrastructure. This proliferation causes complication and confusion for those considering using EV, representing a significant barrier to market growth and investment. For example, a number of different rapid charging mechanisms currently exist across Europe, the US and Asia and also between the manufacturers operating within these areas. This is causing confusion amongst EV drivers and investors as to what charging equipment is required for which EV and how available this necessary infrastructure is to them in their geographic area and beyond. However, this paper has shown how ITS can be used to understand charging behaviour, to inform charging post operators about the most efficient operation of their network and EV drivers about how to get the most from their EV. For getting the output we use the MATLAB software.

LIST OF SYMBOLS & ABBREVIATIONS:

A – Ampere

V – Voltage

SoC – Sate of Charge and Discharge

LIST OF FIGURES

Designing of charger

Output:

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INTRODUCTION

- **Charging station:** An electric vehicle charging station is equipment that connects an electric vehicle to a source of electricity to recharge electric cars, neighbourhood electric vehicles and plug-in hybrids. Charging stations are also called electric vehicle supply equipment (EVSE), These stations provide special connectors that conform to the variety of electric charging connector standards.

  Level 1 charging stations use a 120 volt (V), alternating-current plug and require a dedicated circuit, offering about 5 miles of range for every hour of charging.

  Level 2 stations charge through a 240V, AC plug and require home charging or public charging equipment to be installed. Level 2 stations provide 10 to 20 miles of range for every hour of charging.

  Level 3 chargers are also known as DC fast chargers. Level 3 uses a 480V, direct-current plug. They bypass the onboard charger and provide DC electricity to the battery via a special charging port. DC Fast Chargers provide up to 40 miles of range for every 10 minutes of charging but are not compatible with all vehicles.

- **Bidirectional EV charger:** Increase in electric vehicle mobility has encouraged the growth of vehicle to grid technology. Vehicle to grid technology allows bidirectional power flow between the battery of electric vehicle and the power grid.

This allows peak load shaving, load levelling, voltage regulation and improvements of power system stability. Implementation of the vehicle to grid technology requires dedicated electric vehicle battery charger, which allows bidirectional power flow between power grid and electric vehicle battery.

OBJECTIVE

- Study of different type of charging station.
- Simulate the charging station using MATLAB.

PROPOSED METHODOLOGY

Bidirectional charging:

- **Grid to vehicle:**power flow between the power gridbattery of electric vehicle.
- **Vehicle to grid:** Vehicle to grid technology allows bidirectional power flow between the battery of electric vehicle and the power grid. This allows peak load shaving, load leveling, voltage regulation and improvements of power system stability. Implementation of the vehicle to grid technology requires dedicated electric vehicle battery charger, which allows bidirectional power flow between power grid and electric vehicle battery.

CHAPTER -

LITERATURE REVIEW

This chapter focuses on existing literature related to key concepts of this report's research and addresses the following research objectives:

EV Charging Station Progress: The field of charging behaviour has been found to be under increasing interest of scholars. The number of studies that model charging behaviour based upon assumptions or criteria or driving data from conventional cars for infrastructure planning is increasing. More recently, attention has shifted towards analysing differences in charging patterns from actual EV drivers. Studies that discuss heterogeneity in charging behaviour fall into two categories, those that discuss heterogeneity in charging patterns (e.g., home, workplace and public charging) and those that study heterogeneity in the factors that drive charging decisions pricing and routine behaviour.

Barriers to EV charging station:his overview has shown that a growing body of literature is investigating charging behaviour of EV drivers using revealed preference data. Descriptive studies and random parameter models show that heterogeneity is present in charging patterns and in the determining factors which drive the decisions regarding where, how long, and how much to charge. Understanding this heterogeneity is crucial to correctly predict charging demand. Links between descriptive studies which often show clear habitual patterns and studies that model heterogeneity in charging decision rules are sparse. Furthermore, the literature on determining factors focusses on the decision to charge (or not) and not on the duration of the charging session.

Ways to overcomes Barriers:his overview has shown that a growing body of literature is investigating charging behaviour of EV drivers using revealed preference data. Descriptive studies and random parameter models show that heterogeneity is present in charging patterns and in the determining factors which drive the decisions regarding where, how long, and how much to charge. Understanding this heterogeneity is crucial to correctly predict charging demand. Links between descriptive studies which often show clear habitual patterns and studies that model heterogeneity in charging decision rules are sparse. Furthermore, the literature on determining factors focusses on the decision to charge (or not) and not on the duration of the charging session.

CHAPTER -

LIST OF COMPONENTS FOR SIMULATION

- Three phase source
- Powergui
- 3ph V-I measurement.
- 3ph series RLC load
- Constant
- Goto
- From
- Scope
- Display
- Battery
- Bus selector
- Mux
- Demux
- Connection port
- In port
- Outport
- Ideal switch
- Logical operator
- Universal bridge
- PWM generator (2level)
- 3ph series RLC branch
- 3ph breaker
- Power (3ph instantaneous)
- PLL(3ph)
- Terminator
- Gain
- Rate limiter
- MATLAB function
- Voltage measurement

- Series RLC branch
- MOSFET
- Sum
- PID Controller
- PWM generator (DC-DC)
- Switch
- Repeating sequence.

CHAPTER -

PRACTICAL IMPLEMENTATION

Connection Control:

Connection Control allows you to limit the devices that can connect to the SMTP Server. This can be useful if you are using the service as a relay for locally installed applications by restricting connections to that of the local host. You can alternatively prevent specific computers from connecting to the server. Connections can be evaluated based on a single IP address, a masked IP range, or a domain name.

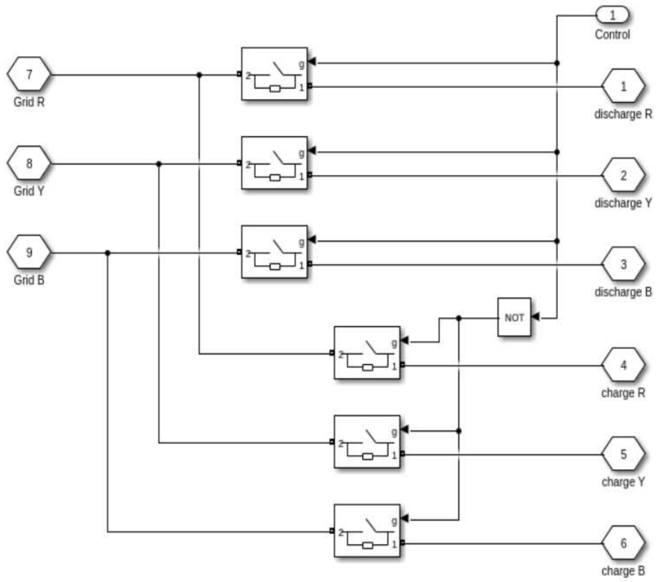

Figure 1: Connection Control

DC to AC and AC to DC Converter with controller:

The system needs a considerable number of power electronics converters and electronic controllers in order to regulate and optimize the power between the components. A DC/AC converter is used to connect the battery to the flywheel low voltage side. An AC/DC/AC converter is used to connect the flywheel high voltage side to the wheel motor.

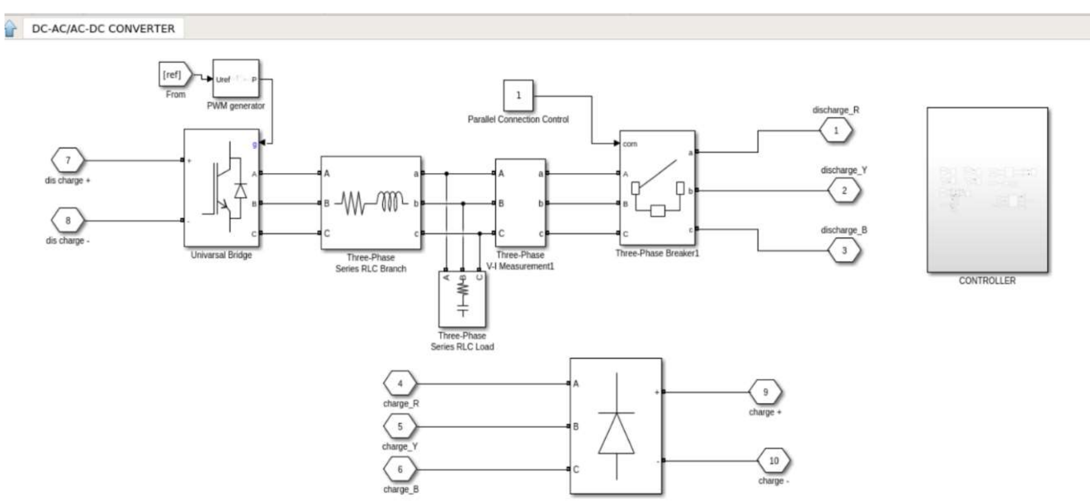

Figure 2: DC to AC/AC to DC Converter with controller

Buck-Boost Converter with Controller:

buck/boost synchronous dc-to-dc controllers utilize an external power switch to deliver high currents with excellent efficiency. With their unique external four MOSFET buck-boost switch combination, they can seamlessly transition from step-down mode, through 100% dropout operation, and then to step-up mode to allow a fixed output voltage even when the input voltage fluctuates above or below the output.
They are particularly well suited to automotive applications where the input voltage can vary dramatically during stop/start, cold crank and load dump scenarios.

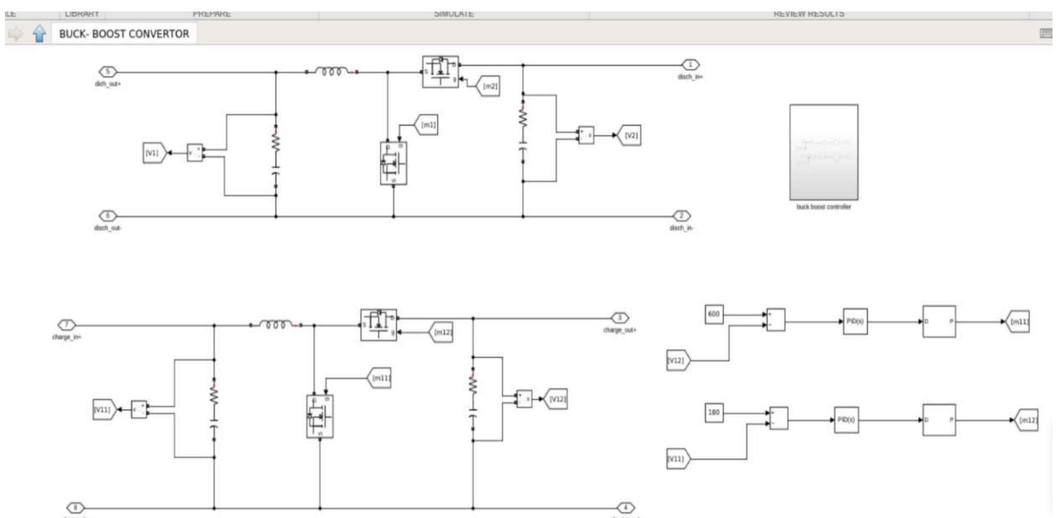

Figure3: Buck-Boost Converter with Controller

DC to DC converter with Battery controller:

Electrical systems that require energy transfer between one voltage level to another, as the voltage required may be different to the voltage supplied. To achieve energy-efficient conversions, switch-mode conversion is used.

The three-generic switch-mode DC/DC converters that will be explained are Buck, Boost and Buck-Boost DC/DC converters as well as the PWM required to control them.

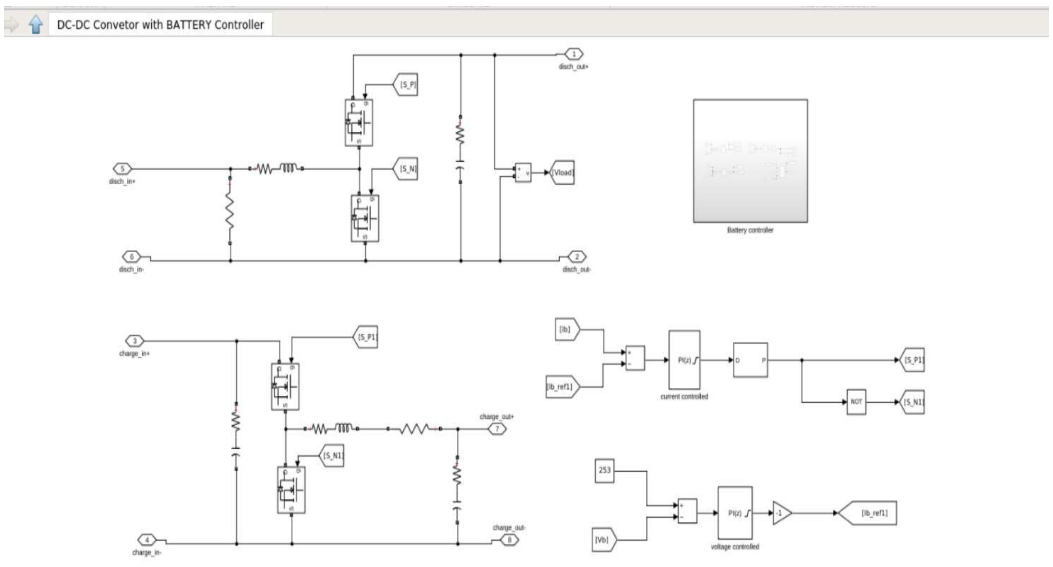

Figure4: DC to DC converter with Battery controller

Switching controller:

A switching controller is an IC that controls the timing of the switching of a power transistor, usually a FET (field-effect transistor), used in a switching regulator. In some switching regulators, the FET is a discrete component, external to the controller, while in others, the FET is located in the same IC as the switching controller.

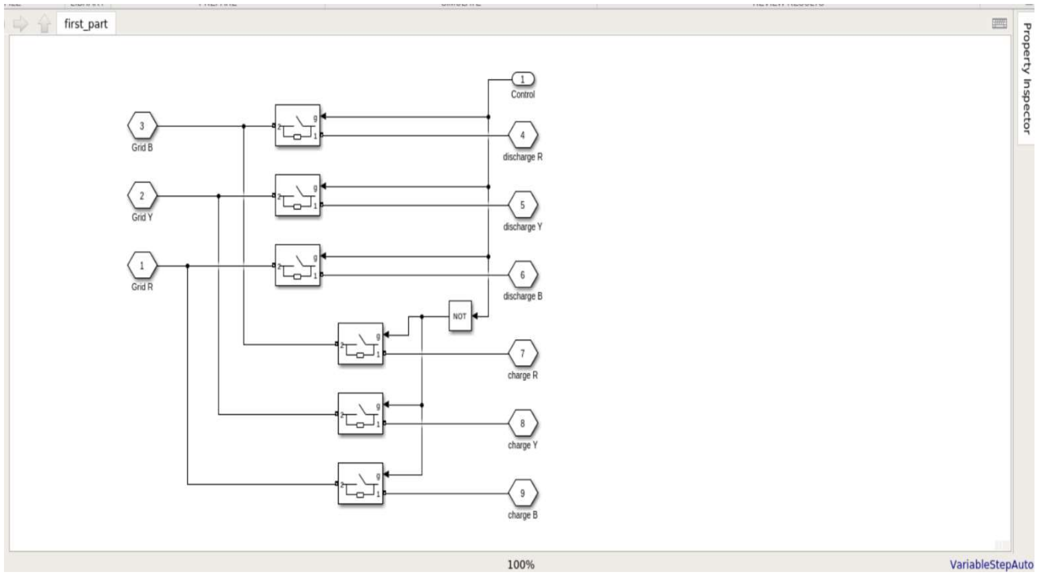

Figure 5: Switching controller

Wall Charger Connection Box:

The Wall Charger Connection Box is a combination of all boxes like Connection Control, DC to AC and AC to DC Converter with controller, Buck-Boost Converter with Controller, DC to DC converter with Battery controller, switching controller where each box connects to another box with respect to their input output port.

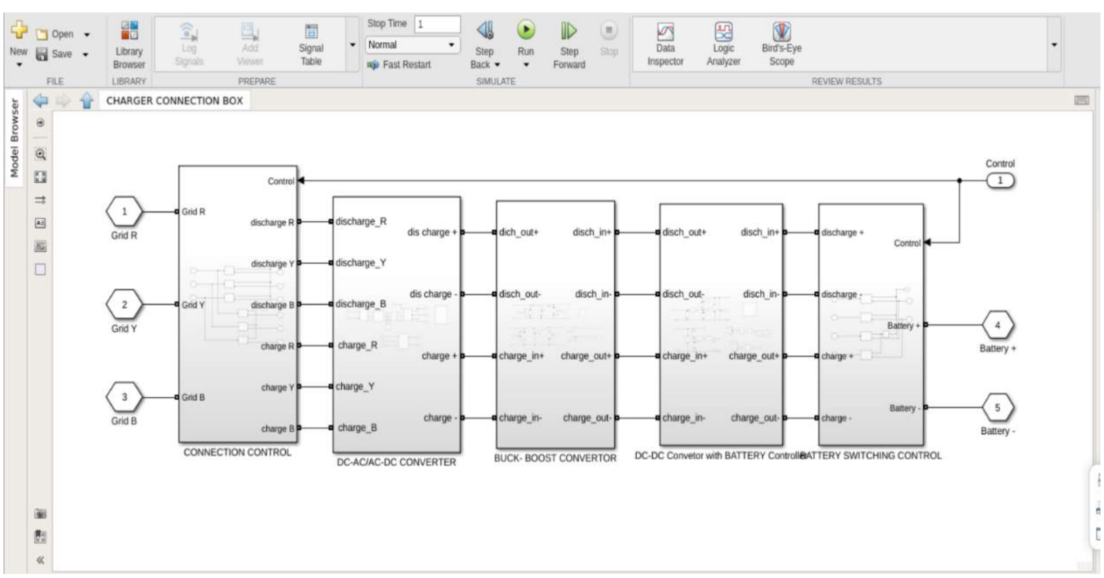

Figure 6: Wall Charger Connection Box

Bidirectional Charger:

the *bidirectional charger* selects the *charge* or discharge mode, based on the indication via CAN communication. Output power and operation mode of the *charger* is arranged by the *charge* control ECU, in consideration of the requirements from the EVSE and SOC of the on-board battery.

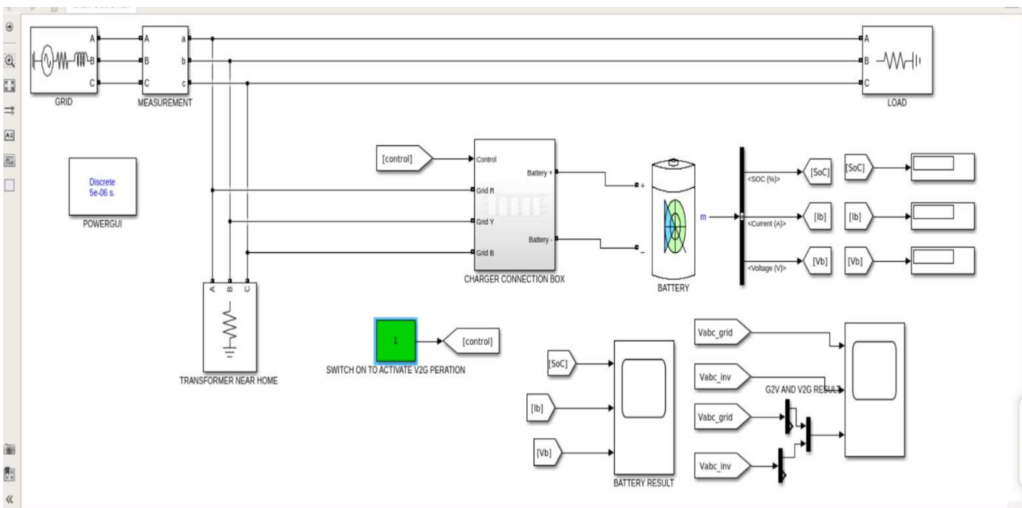

Figure 7: Bidirectional Charger

SIMULATION DIAGRAMS

Here we are using constant box as a switch where when it show zero then it work for grid to vehicle supply and at one it work for vehicle togrid supply.

Grid to vehicle operation: When we charge battery (G2V operation), soc will increase and battery current will be negative,battery voltage will be positive.

there is no inverter voltage

SoC - 60
Voltage – 247.2V
Current – 24.72A

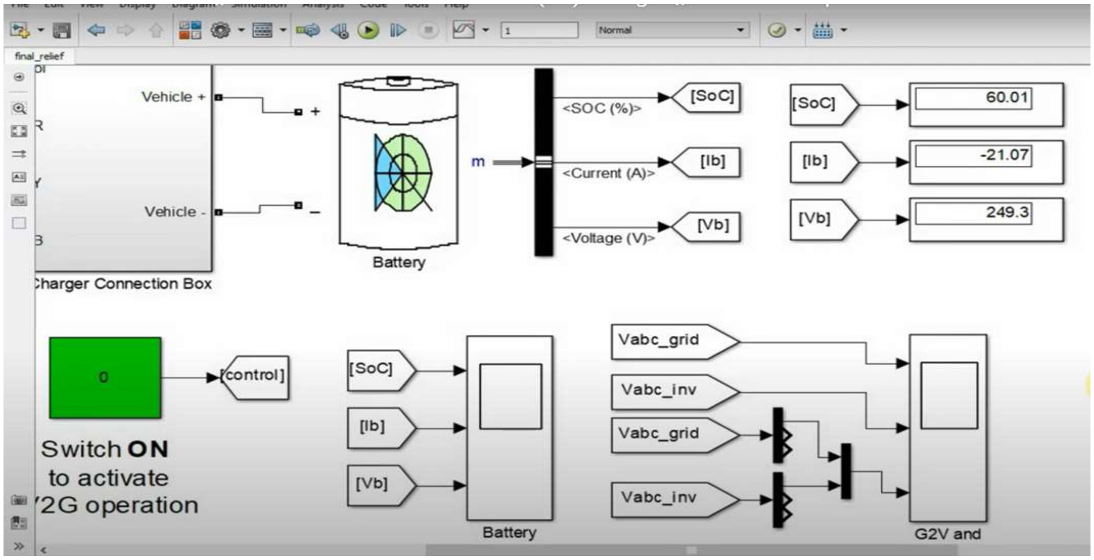

Figure 8: G2V Operation (Switch mode 0)

Vehicle to grid operation: During V2G operation soc will decrease and battery current and battery voltage will be positive.

SoC - 60
Voltage - 250V
Current – (-21.07)

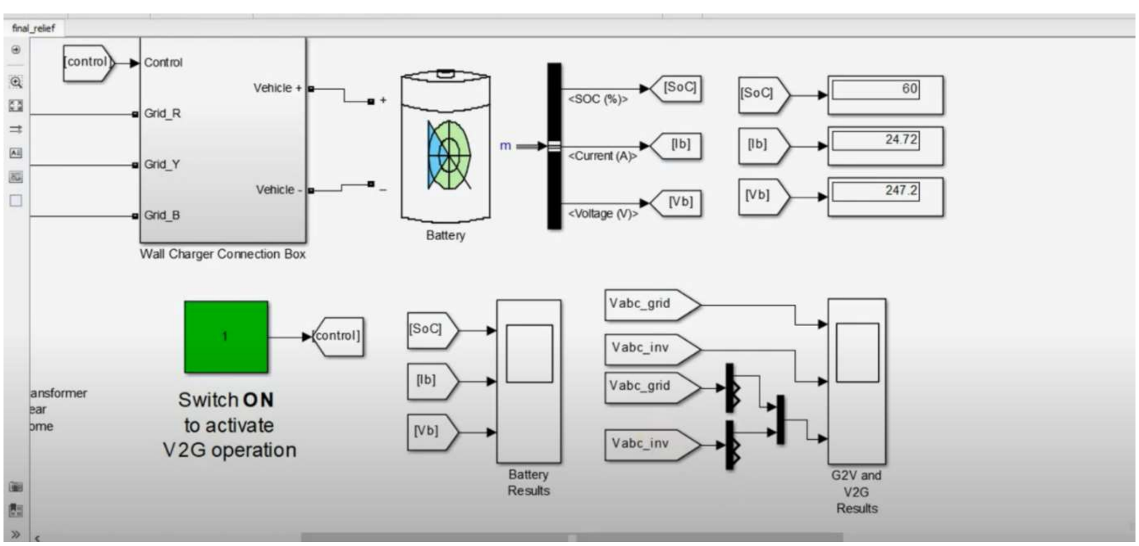

Figure 9: V2G Operation (Switch mode 1)

CHAPTER -

RESULT AND DISCUSSION:

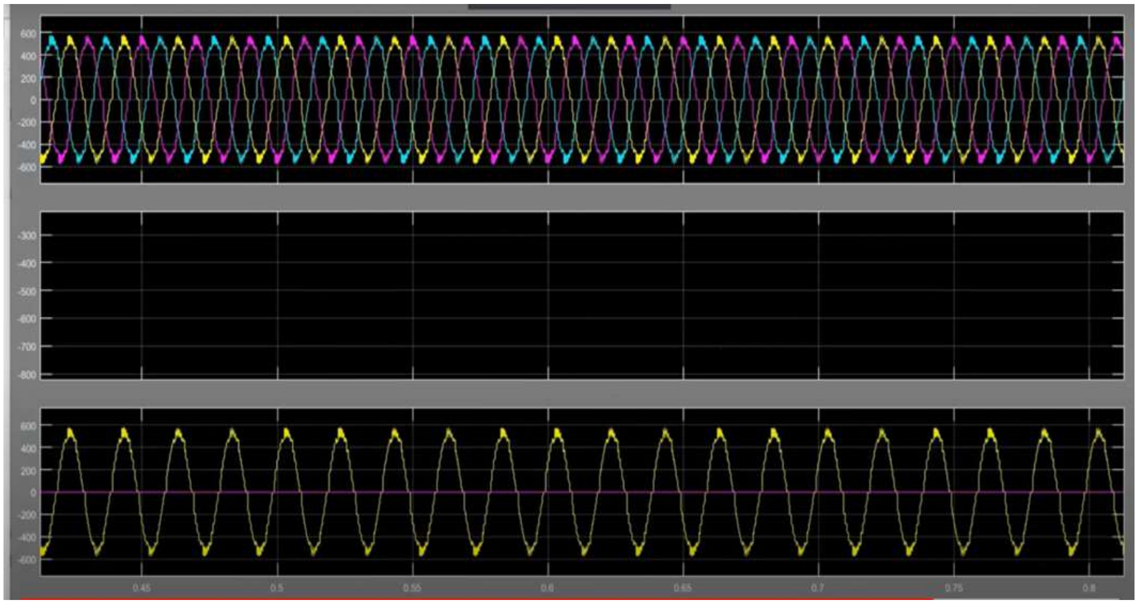

Figure 10: G2V Operation_ grid input (Switch mode 0)

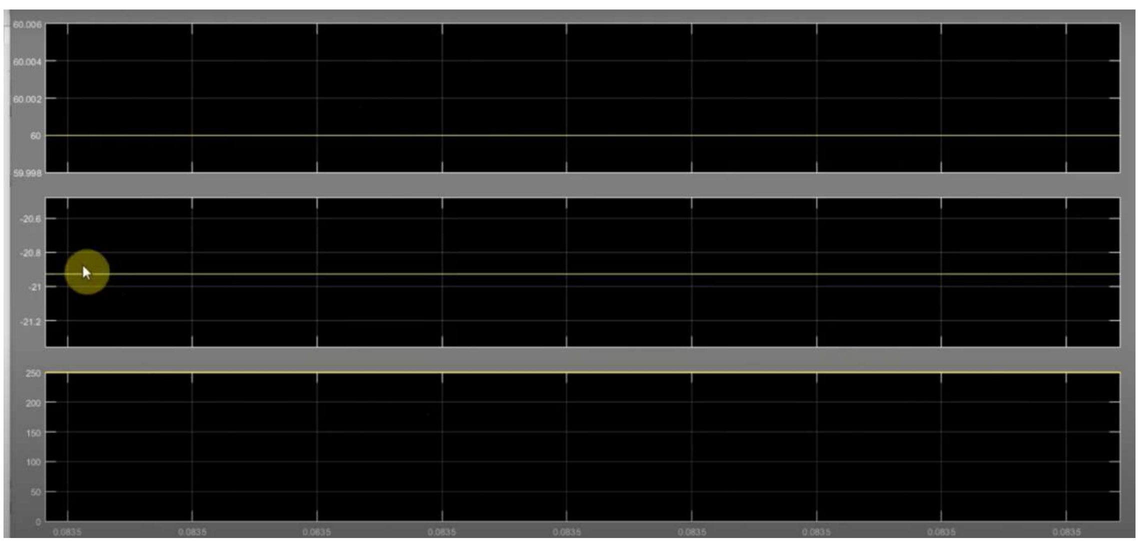

Figure 11: G2V Operation_ Battery output (Switch mode 0)

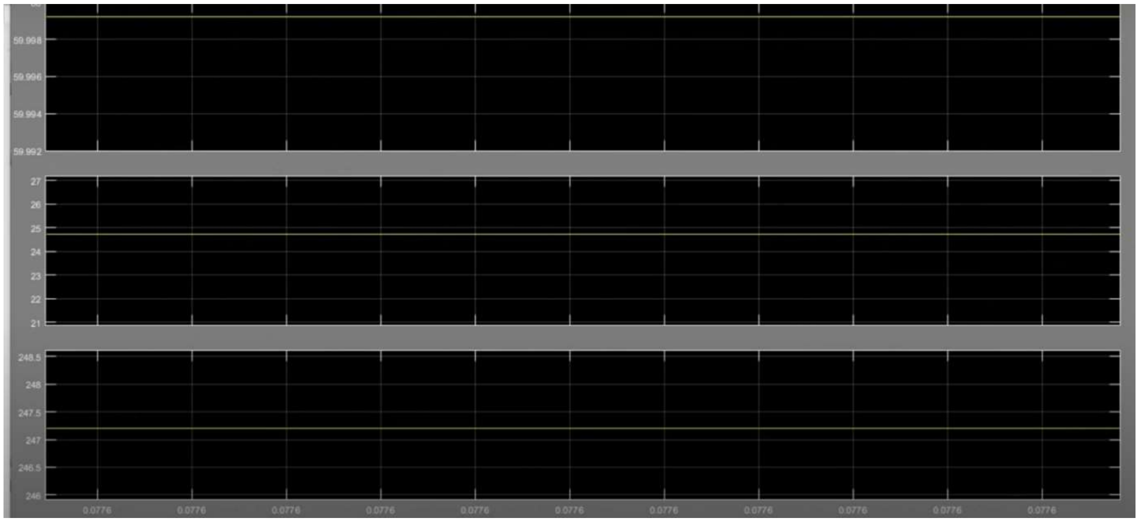

Figure 12: V2G Operation_ Battery Input (Switch mode 1)

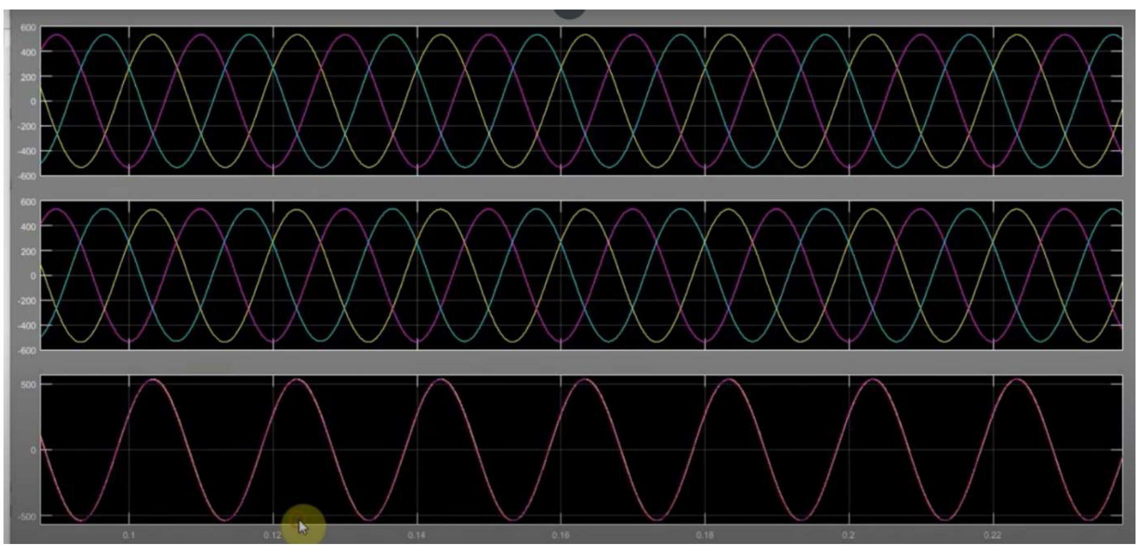

Figure 13: V2G Operation_ Grid Output (Switch mode 1)

PRESENT AND FUTURE SCOPE OF PROJECT:

Design the charging station of different level where at a same time we can charge more than 100 electrical Vehicle with low cost and minimum time.

CONCLUSION

This report proposes to the effectiveness of EV Charging Station where we can do fast charging, at same time we can charge one and more than electrical vehicle 30-40minute time duration.

On the conclusion point:

- Changed behavior is important for transition towards e-mobility.
- Customized regional and city planning for e-mobility.
- Develop smart charging systems

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