ISLANDING DETECTION AND TRANSIENT OVER VOLTAGE MITIGATION USING WIRELESS SENSOR NETWORKS

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INTRODUCTION

- A lack of proper network protection may cause network instabilities as the number of DG units have been increasing.
- Islanding detection is one of the critical issues in this context.
- In this situation, Transient Over Voltages (TOVs) might arise if the DG power exceeds the load.
- Because of the adverse effects of islanding and TOVs, power system sections must detect and mitigate the TOVs, as well as disconnect the DG systems from the grid if necessary.
- This work proposes a communication method based on wireless sensor networks for islanding detection.
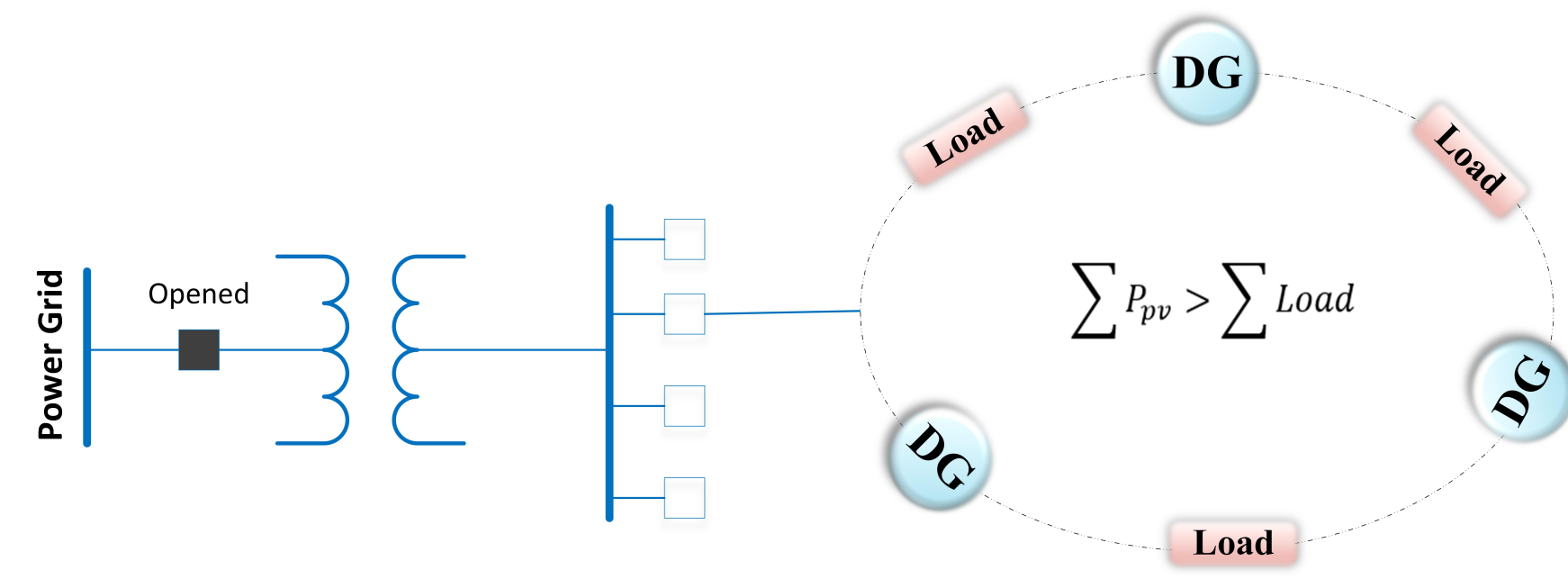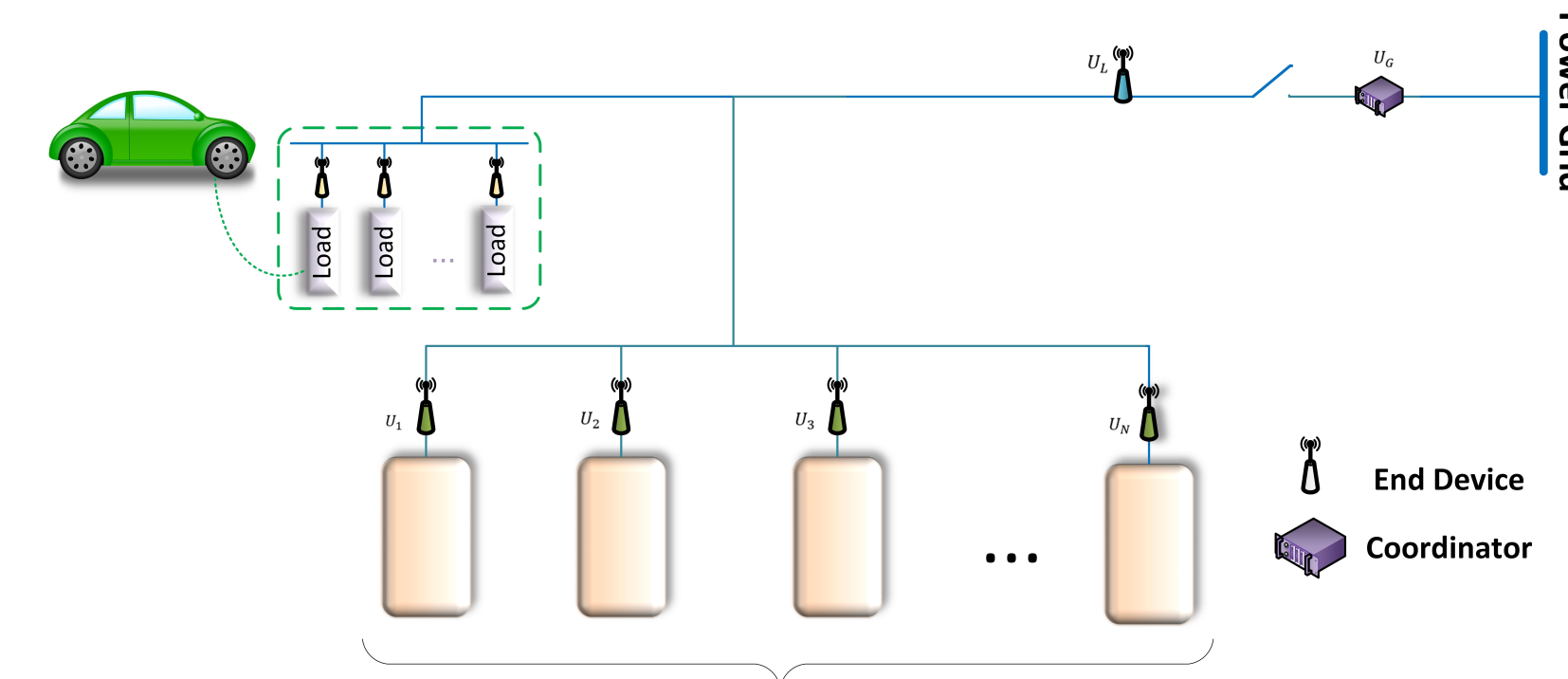

NETWORK TOPOLOGY
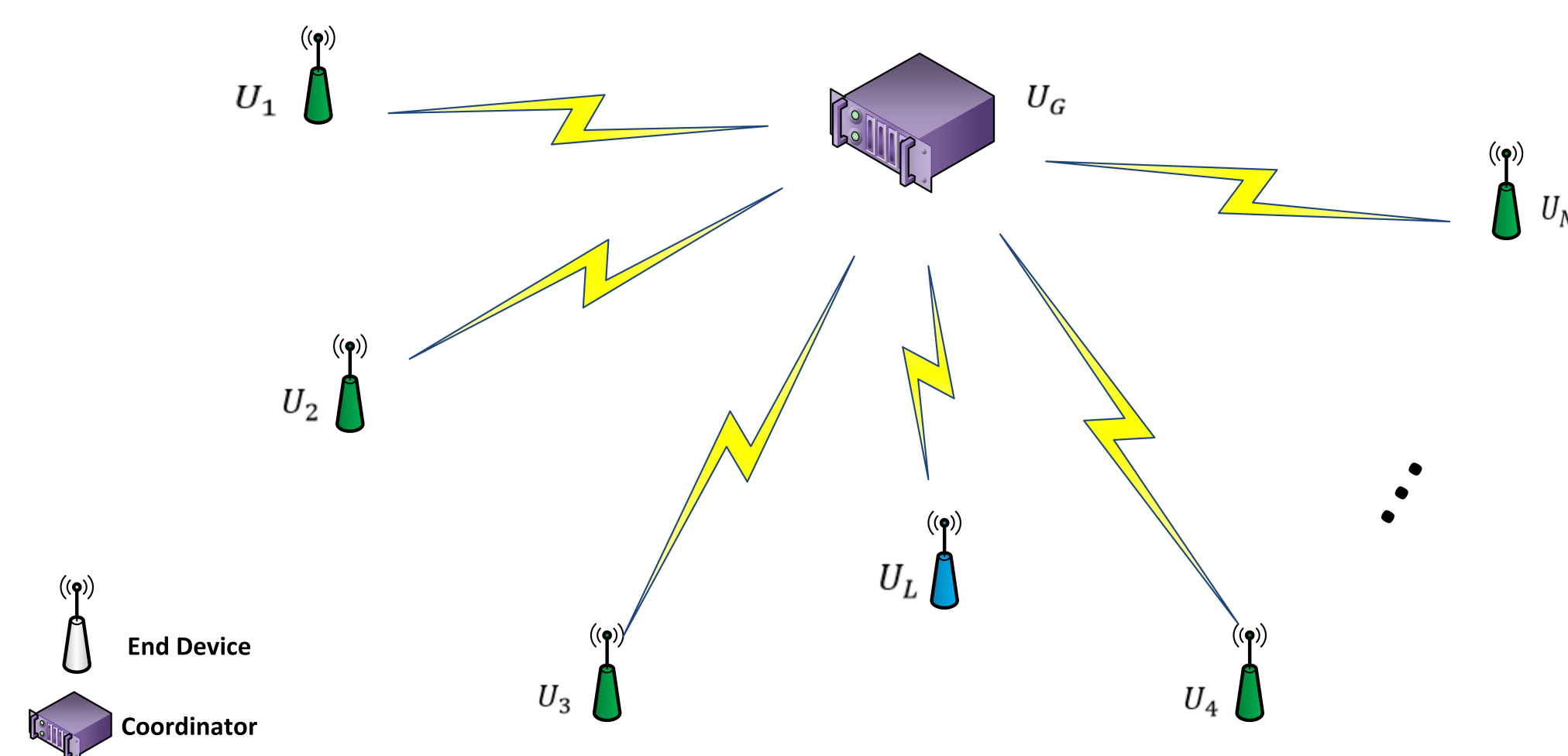
- Islanding detection with the minimum delay is necessary
- Covering the power section system through one-hop ZigBee communication
- Star topology is used for the ZigBee network
- The U_G is the coordinator and $N + 1$ other units are end devices
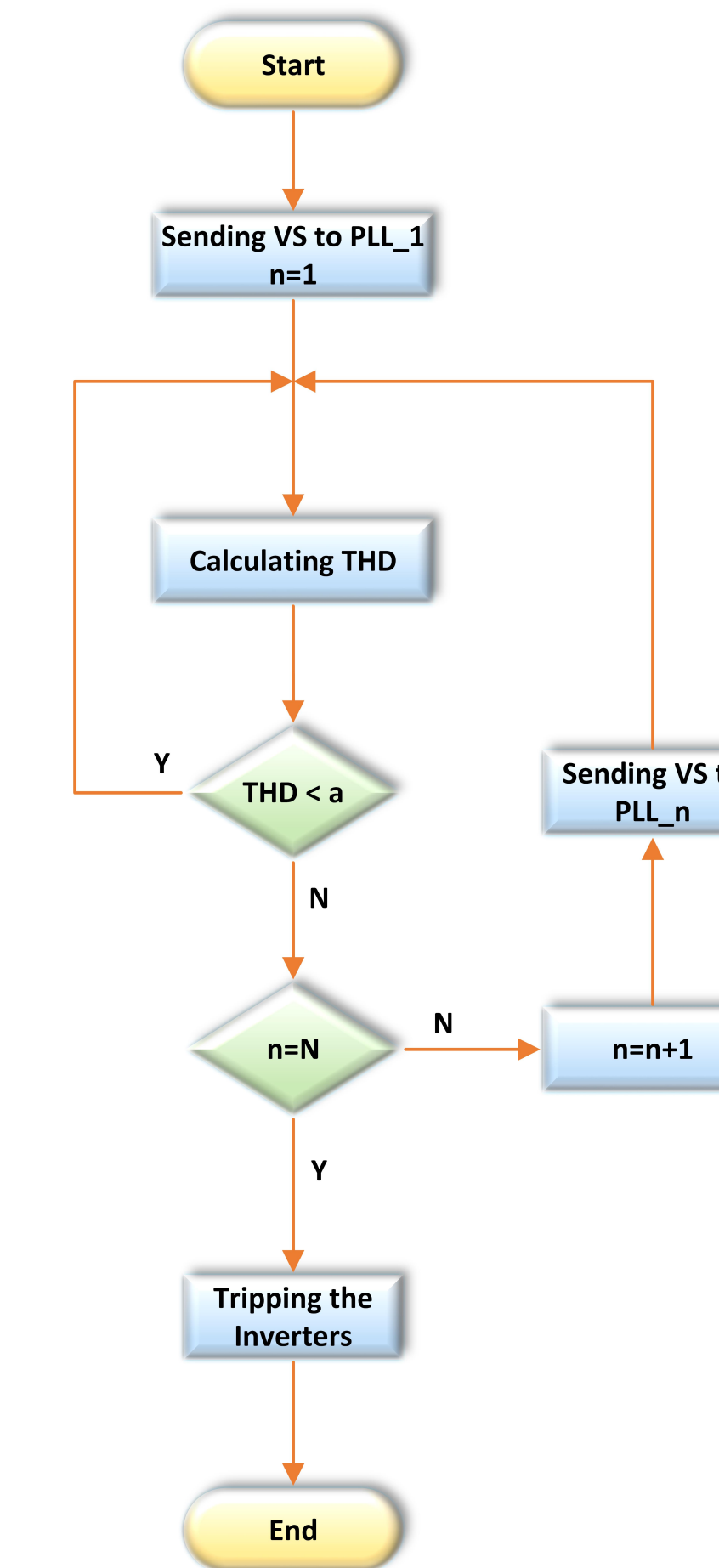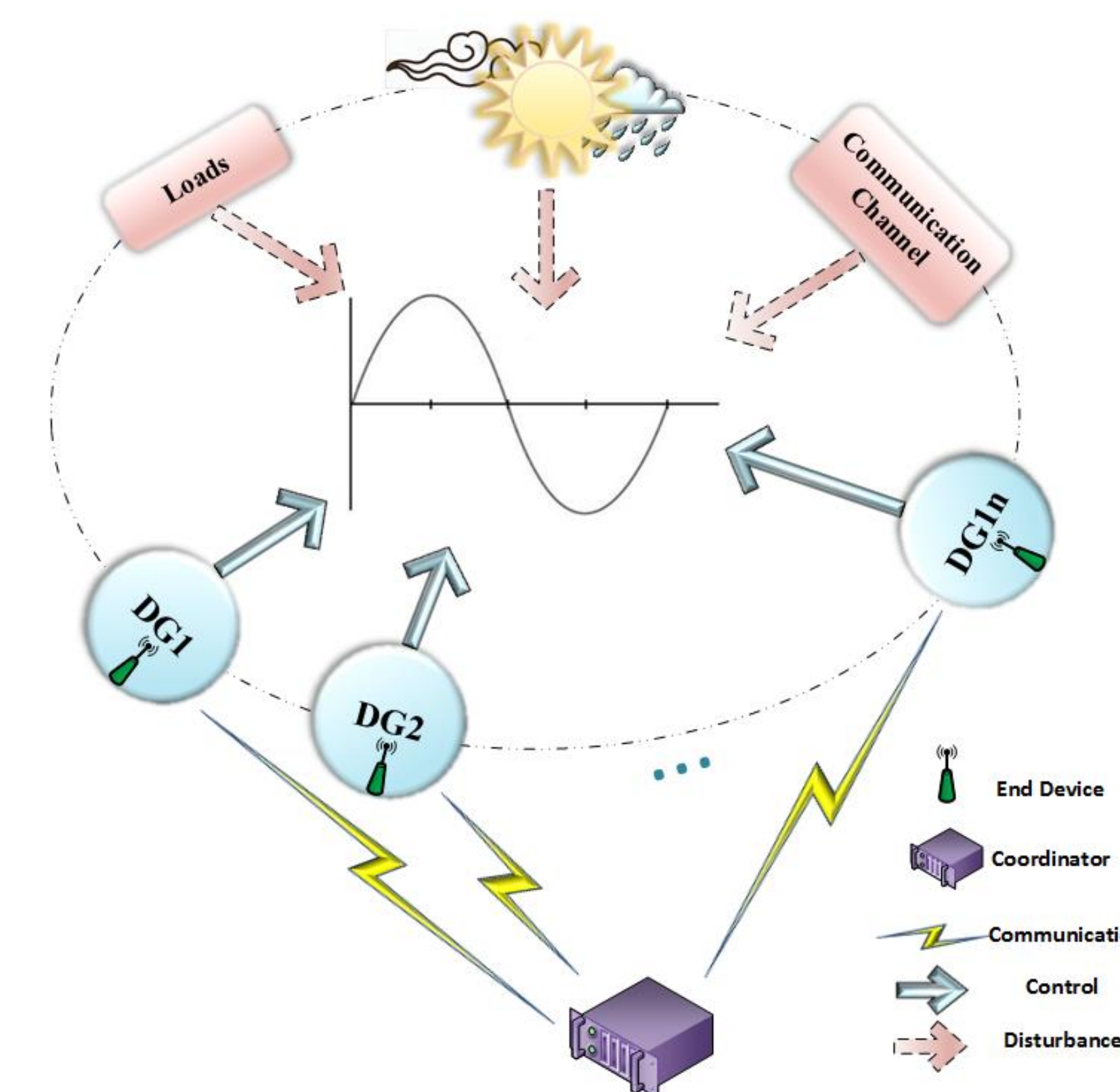
PROPOSED METHOD

- Figure shows the diagram of the power system section equipped with the proposed method
- N is the number of units with the PV panels (or other DG sources)
- A ZigBee sensor is assigned to each unit ($U_1 - U_N$)
- U_L is the ZigBee sensor for the line after the switch and U_G is the sensor for the grid side
- Some loads are added to manage the voltage level in the islanding condition
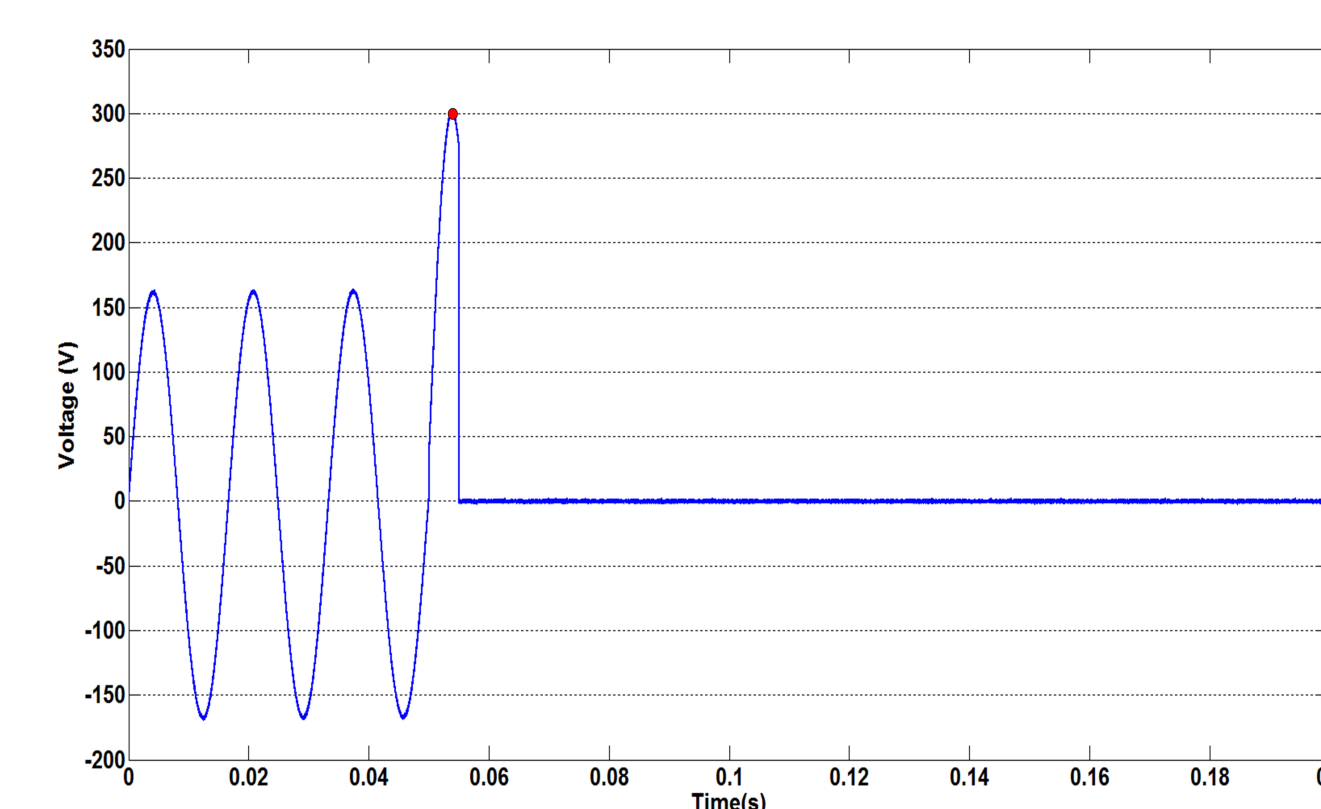
SYNCHRONIZATION

DETECTION & MITIGATION

Figure 1: Detecting algorithm for the end devices

Figure 3: Mitigating the Voltage

Figure 2: Detecting algorithm for the coordinator

Figure 4: Tripping the Inverters
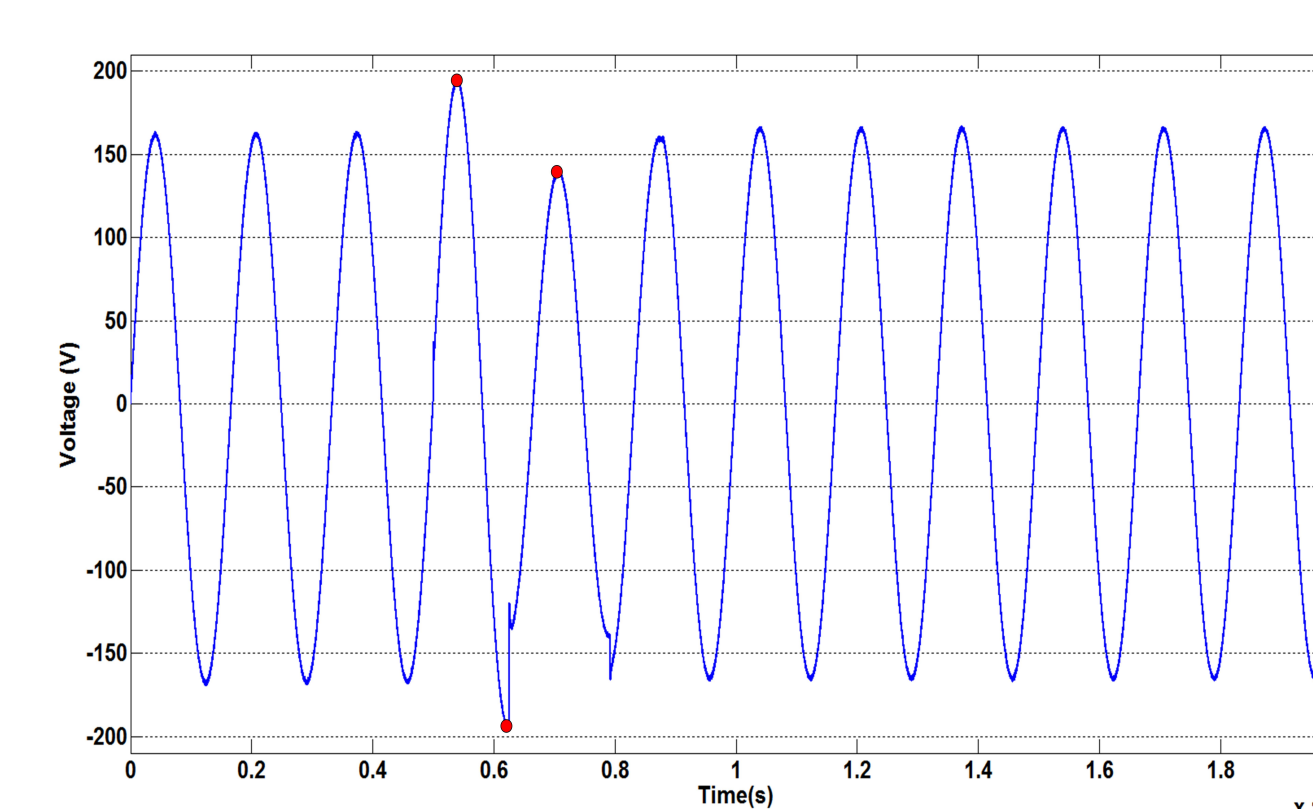
RESULTS

Figure 5: Tripping the inverters

Figure 6: Successful mitigating
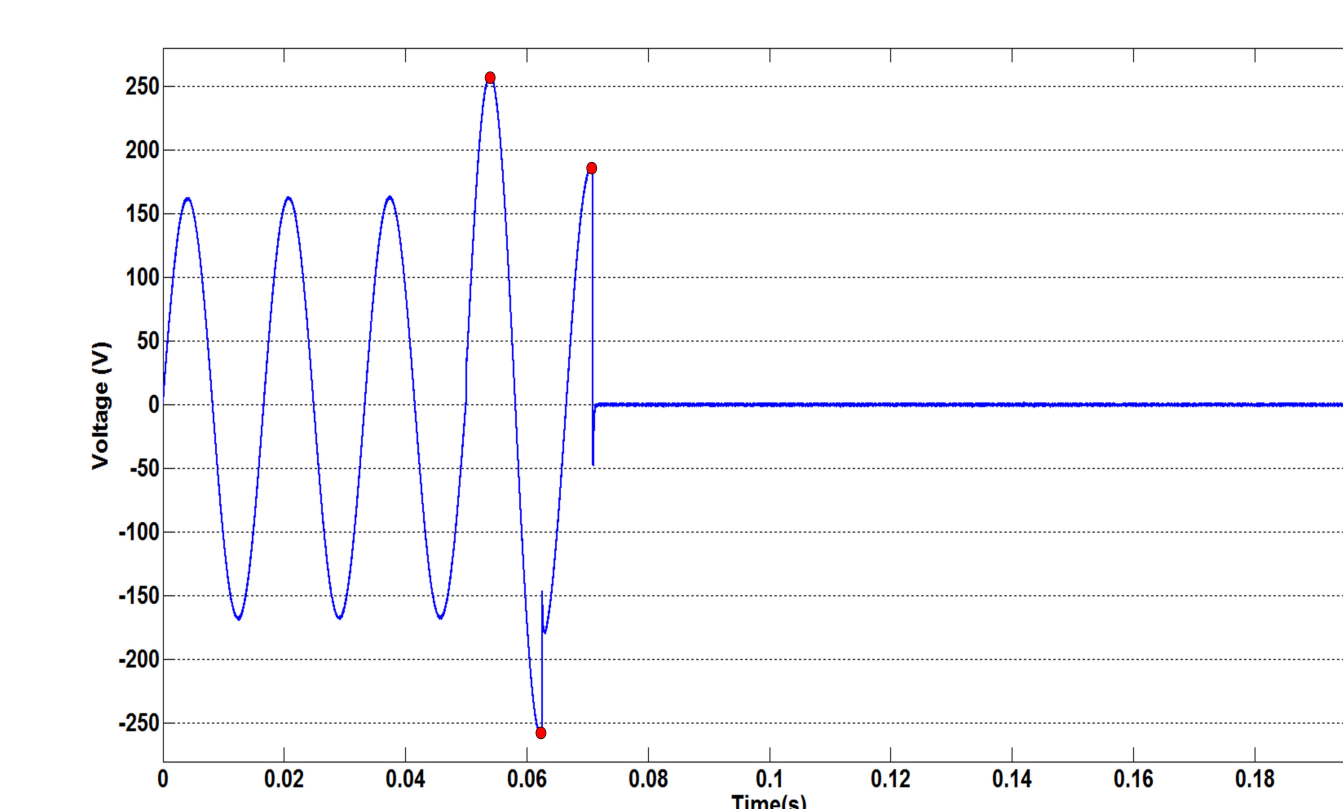
Figure 7: Tripping the inverters after unsuccessful mitigating TOV

Figure 8: Synchronization

ACKNOWLEDGEMENT
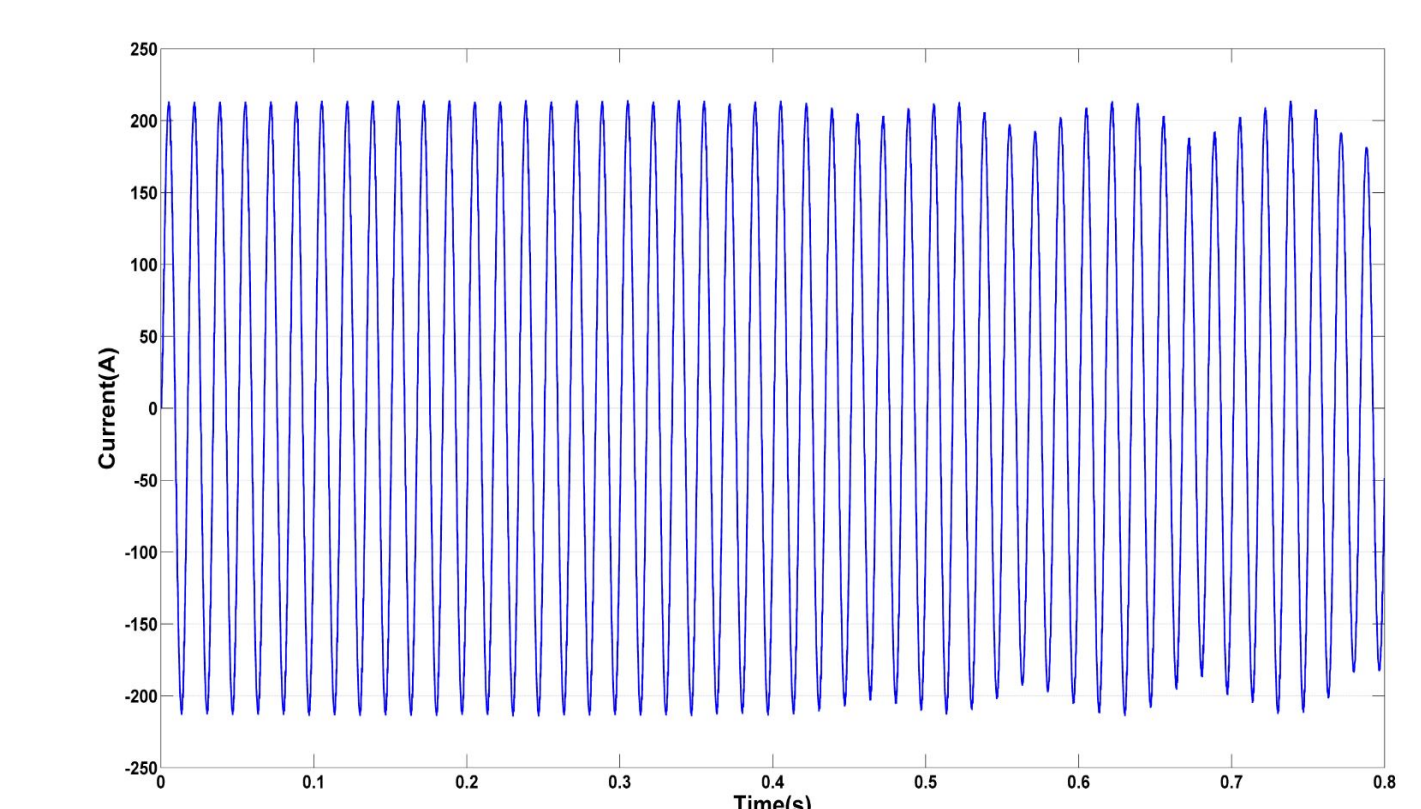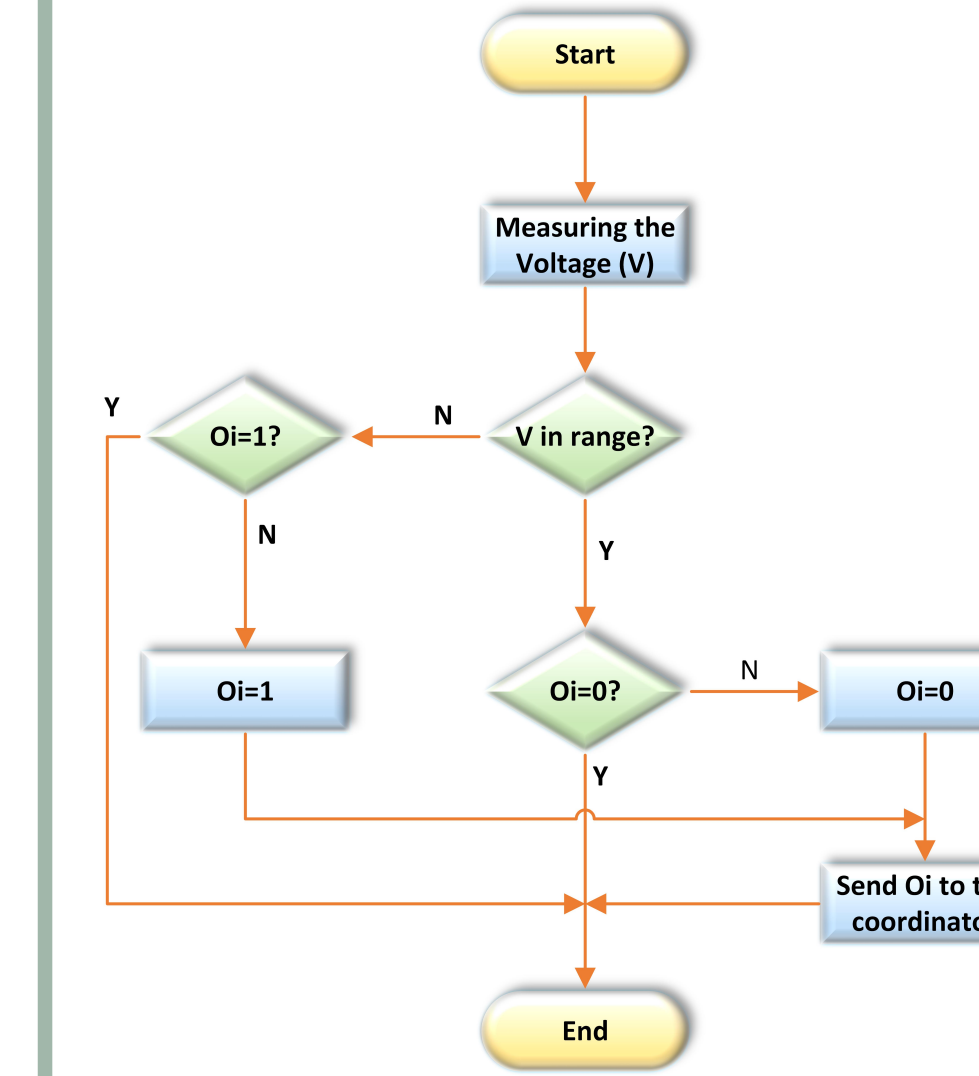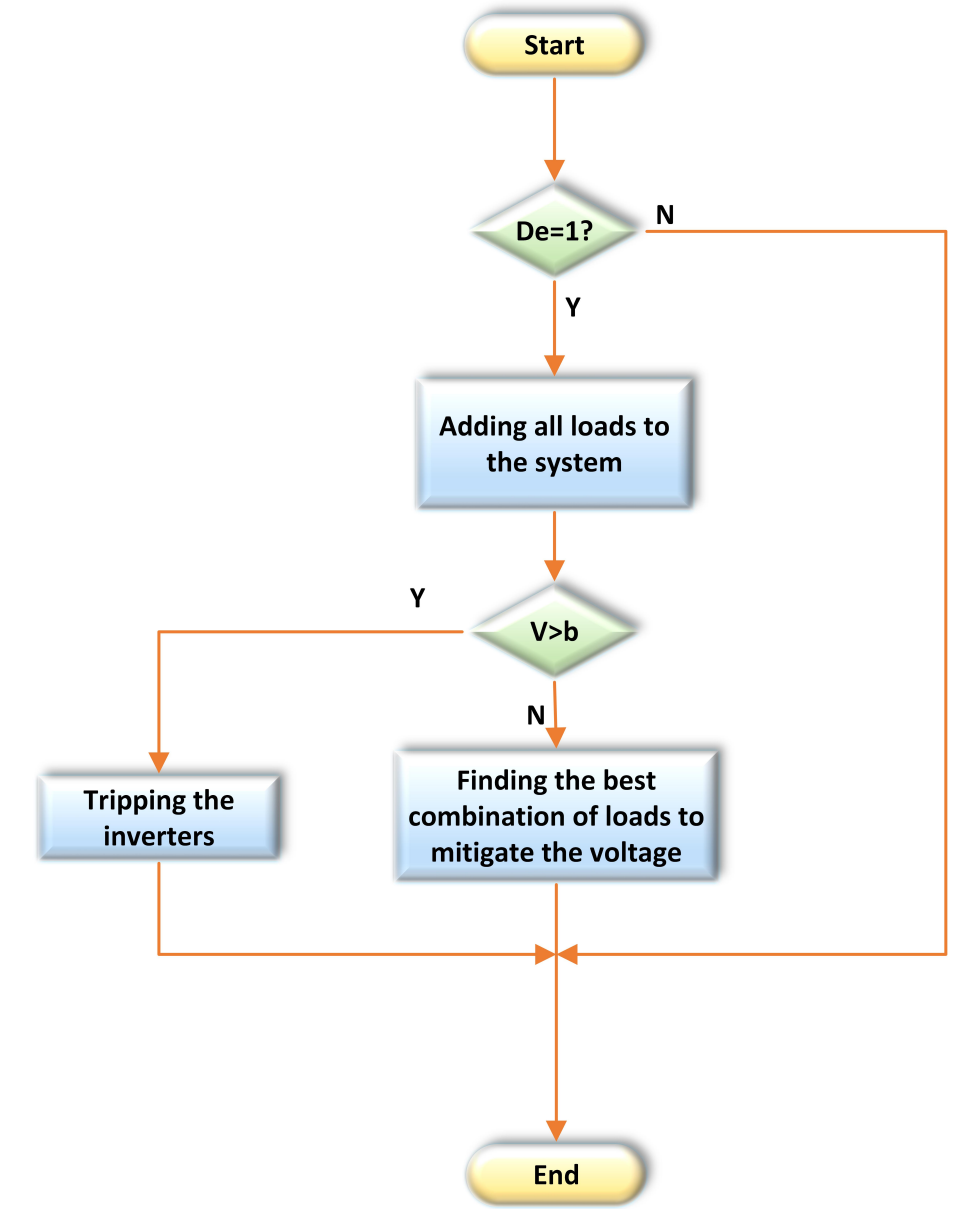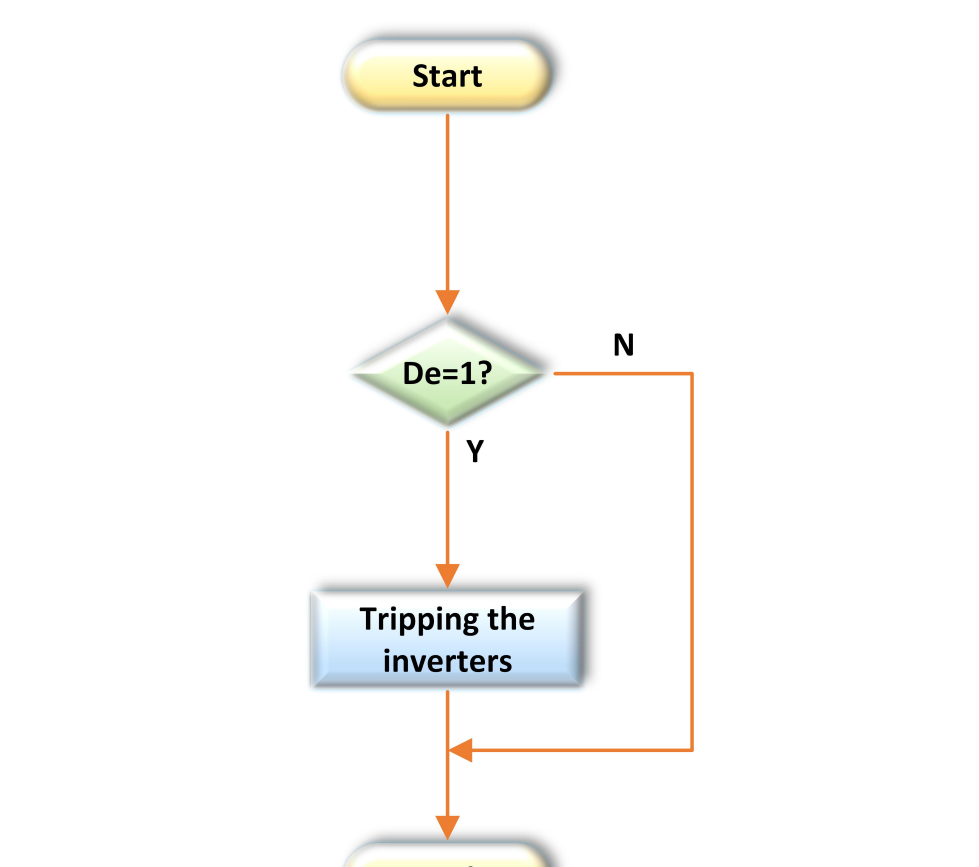
CONCLUSION

- This work presents an islanding detection method based on IEEE 802.15.4 standard.
- Islanding can be detected faster using this communication method.
- This algorithm uses a group of sensors in order to overcome the communications and measurements errors.
- After islanding has been detected for mitigating TOVs, some additional loads are added to the power system section.
- Coordinator sends Virtual Signal to DG(s) to synchronize them together.

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