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Modelling and Simulation SMART GRID SYSTEM in Simulink

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Abstract

Energy Generation is a big problem in developing and developed countries. Its supply and demand are issues as Energy Consumption is always higher than Energy production. Renewable Energy sources are playing a significant role in bridging the gap between energy generation and consumption. Photovoltaic Solar panels and wind generators are now widely available that can be usedin order to conserve non-renewable resources. Wind Generator with Doubly-fed induction generator (DFIG) system is quite common in which the power electronic interface controls the rotor currents to achieve the variable speed necessary for maximum energy capture in variable winds. Exhaustion of Non-renewable Energy sources also leads to environmental problems. Therefore, there is the time to use renewable energy sources from non-renewable power sources such a way, which maximizes the use of power generated by renewable resources without affecting the power system. There should be an intelligent power system that can use the electrical power from renewable resources and only needs to use non-renewable power sources if renewable power is either not available or not fulfilling the required demand, which is the primary function of Smart Grid Power Network. So, a smart grid is an electrical grid, which includes a vast variety of operations and energy measures, including smart meters, smart appliances, renewable energy resources, and energy-efficient resources. In this paper, different types of energy sources both non-renewable and renewable,are connected and simulation is done with the help of Matlab Simulink Tool Box. A simulation fault block is playing an important role in creating different types of fault. The Three-Phase fault block is used the same way as a Three-phase circuit breaker in which opening and closing time is controlled either from an external Simulink® signal (external control mode) with the help of step time or from an internal control timer (internal control mode) by directly entering values. So, in this designed model of the smart grid power system, various types of faults are created, the impact is analysed on the purposed model, and uninterrupted electrical power supply is achieved by the designed intelligent selection switch.

Keywords— Implementation of Smart Grid, Simulation of Power System, Efficient Use of Energy.

Introduction

Electrical power is the need of every person from day to day activities either for domestic purposes or for industrial purposes. A smart grid is an electrical grid, which includes a huge variety of operations and energy measures, including smart meters, smart appliances, renewable energy resources, and energy-efficient resources (Delamare, 2015). There should be an intelligent power system that can maximize the use of electrical power from renewable resources and only needs to use non-renewable power sources if renewable power is either not available or not fulfilling the required demand, which is the primary function of smart grid power network. A future smart grid power system network is a dynamic network for bi-directional energy flows, linking widely distributed small capacity renewable energy systems at consumer level (distribution network) and centralized higher-capacity power generators, facilitating active participation of customer choice for energy production/source and demand management, and providing real-time information on the performance and optimal operation of the power system network.

The smart grid is technically classified in three categories as below (Kumar, 2014):

- Smart Management System
- Smart Protection System
- Smart Infrastructure System

Designing of the smart grid depends on various elements such as user-demand, centralized, and decentralized energy production, storage elements, etc. A smart grid at the neighbourhood level also involves several houses with a set of typical smart grid scenarios. Each house may have solar panels, a battery, etc. and its individual demand profile real-life gives insight into how the energy flows within a house and the neighbourhood and thus can help in a smart grid design (Delamare, 2015). Furthermore, due to the modular set-up of the model, the designed simulation model should be easily extended to incorporate other devices and scenarios as a future extension.

Basic Block Diagram

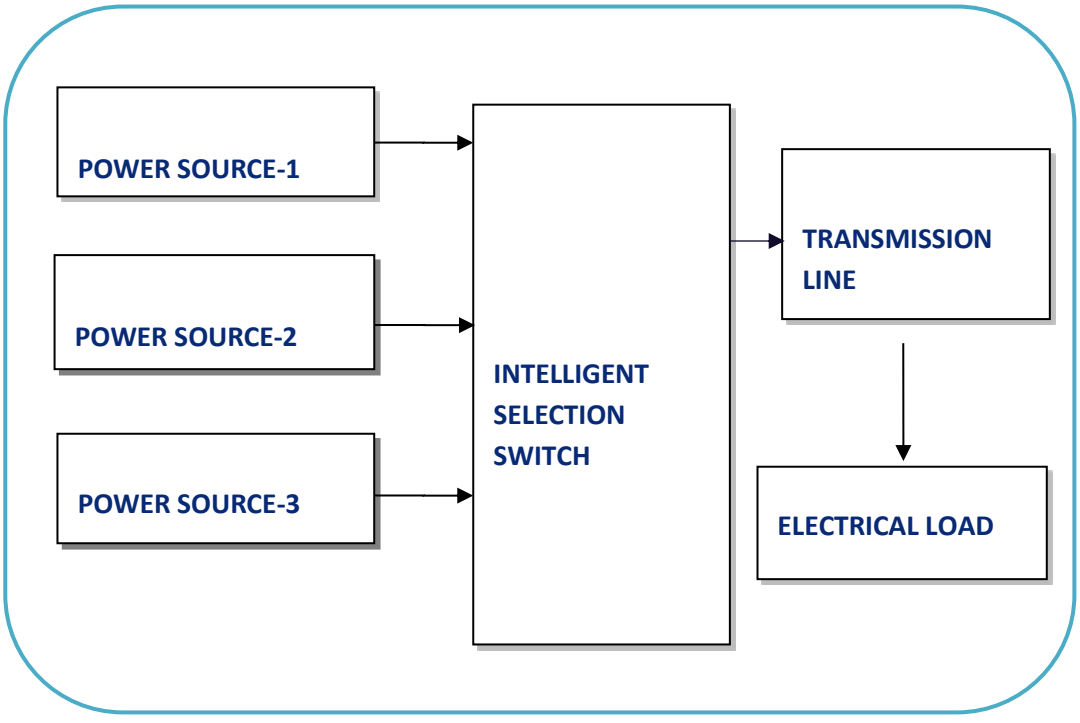


Fig1: Basic Block Diagram

The basic block diagram of the Smart Grid Power System is above. It has four electrical power sources; three are non-renewable electrical power sources and one DFIG or wind energy source from renewable sources (Acakpovi, 2014). The intelligent selection switch is used to select the appropriate electrical power sources. The transmission lines are used to distribute power from source (Generation) point to end (Electrical Load) point. The Transmission line can also be in between Power Sources and Intelligent Selection Switches.

Literature Review

In this work, Natsheh (2011) have analysed that performance optimization system reliability and operational efficiency are key characteristics of smart grid systems. The author represented a novel model of a smart grid-connected PV/WT hybrid system. It comprises a photovoltaic array, wind turbine, asynchronous generator, controller, and converters. The model was implemented using MATLAB/SIMULINK software package. Perturb and observe (P&O) algorithm is used for maximizing the generated power based on maximum power point tracker (MPPT) implementation.

In this paper, Benkhelil (2012) has presented a technique to design and control of grid-connected PV generation system, identify its components, and describe how it works. To convert the solar energy efficiently, the MPPT algorithm for photovoltaic systems based on P&O algorithm has been presented and shown the control performance, and dynamic behaviour of the grid-connected photovoltaic system provides excellent results, show that the control system is robust, and efficient.

In the proposed system Kumar (2014) has designed Smart Grid with MATLAB/SIMULINK for synchronization of Thermal and Wind power plants. Stability in terms of frequency deviation is also checked and analysed of Active power and grid frequency since the standard frequency deviation is defined in the +3% range. The initial value of the inductive and active load is taken as 150 MVAR and 1100 MW at load bus bar B3 and 120 MVAR and 1900 MW at B6, respectively. At these load values, maximum and minimum frequencies obtained as 50.292 Hz and 49.90 Hz.

The authors Delamare (2015) has developed a smart grid simulation tool, which can model residential units that have solar panels and batteries that can store excess energy. Different living situations are available for the residential unit to allow for a more diverse data set when scaling the model to the neighbourhood level. Algorithms can be

implemented to study the behaviour in different scenarios, such as the purchase/sale of power according to the market price.

Different type of analysis Kumar (2014) such as load analysis of the smart grid to check the stability in terms of active power flow is studied. Active power values at all buses have been changed concerning changes in active and inductive load values at bus bar B3 and B6 keeping the capacitive load constant. The frequency has also been measured, and keeping values of both active power and frequency, the magnitude of the inductive and active load has been deduced while maintaining synchronism of the proposed smart grid model.

In this paper, Narendra (2017) Modeling, simulation, and implementation of the solar photovoltaic cell using MATLAB/SIMULINK is discussed. The P-V & I-V characteristics are obtained as they increase the solar radiation, higher would be the solar input to the solar cell, and hence power magnitude would increase for the same voltage value. With an increase in solar radiation, the open-circuit voltage increases.

In this work, Jen Liu (2017) stated that there was an increasing number of micro-grid applications for power system networks at different voltage levels. The community micro-grid systems were also being encouraged in order to increase energy efficiency, reduce electricity bills, and alleviate the reliability problem with respect to power delivery for local residential users. Also, calculations of electricity bills depending on two electricity rates were discussed, representing the benefits of electricity bill reduction when electricity users accepted the power supply from community micro-grid systems.

In this analysis, V. Jayalakshmi (2018) analysed that MPPT and Fuzzy Logic is used to improve the performance of Smart Grid. Because the actual energy conversion efficiency of PV and wind energy systems using traditional controllers is quite low, MPPT with intelligent control techniques was used, and the Fuzzy logic controller and PI controller are used to controlling the duty cycle of the converter switch, thereby extracting the maximum power from the solar array. The system consists of photovoltaic (PV) array, wind energy conversion system (WECS), a boost converter, and LC filter. The entire proposed system has been modeled and simulated using MATLAB/Simulink software.

Matlab Simulink

Matlab Simulink is a tool for simulating dynamic systems with a graphical interface specially developed for this purpose (Kumar,2014). Within the Matlab environment, Simulink is a Matlab toolbox that differs from the other toolboxes, both in this special interface and in the “programming technique” associated with it. Matlab Simulink has various kinds of toolboxes, but in this work, sim power systems are used for simple manipulation and analysis.

Simulink Model:

The figure below shows the detailed block diagram of Smart Grid Work. In this work, two sources are modelled and evaluated in which one is non-renewable, and the other is a renewable energy source.

1) Wind Turbine (DFIG)
2) Electrical Energy Source

It consists of Wind Turbine, Step-up transformer, Three-phase measurement block, transmission Lines, Grounding transformer, Three-phase load with the three-phase breaker on one side and electrical power source, Three-phase measurement block with Three Phase breaker on another side. The three-phase load is common between the two sources of power, but it can also be different. For Fault generation, fault block is used along with trigger Generator. Scopes are also implemented for viewing and analysis of various waveforms.

Wind Turbine is used as a source of renewable energy. Wind energy is converted to Electrical energy once it connected to Generator called DFIG (Doubly Fed Induction Generator). The output of DFIG from the Wind turbine is fed to Step-up transformer. A step-up transformer is used to increase the level of voltage. Because the Wind Energy along with DFIG is quite far away, maybe in 100 or 1000 kilometres from actual consumption so two different transmission lines are inserted to make this model or work as practical as possible. Two three-phase measurement blocks are connected for analysis purposes. One is connected after both transmission lines towards the load with respect DFIG power line, and the other is connected in an electrical source power line towards the load. Grounding Transformer is used to provide the neutral in the Three Phase system.

Fault-block is used for creating various kinds of fault. Fault can be trigger on internal timing-based or external control to make it ON or OFF. The step function is used to specify the duration of time for the trigger. Three Phase Breaker is used to make or break contacts of all three phases. Same as Fault block, this block can also be controlled either internal timing control or by an external trigger.

The electrical energy source is connected three-phase breaker with an external controller and three-phase measurement block, then to the three-phase load.

The three-phase breaker is normally open at the electrical sources side and normally closed at DFIG sources side.

The smart intelligent switch is responsible for the whole operation. It consists of comparator circuitry with a mathematical or digital operation that compares all three voltages with suitable constant values and gives an output that will be responsible for either switch “ON” or “OFF” DFIG or Electrical power source. A “NOT” or Inverter operator is used for selecting between these two. Again, a scope can be used to analyse various kinds of waveforms.

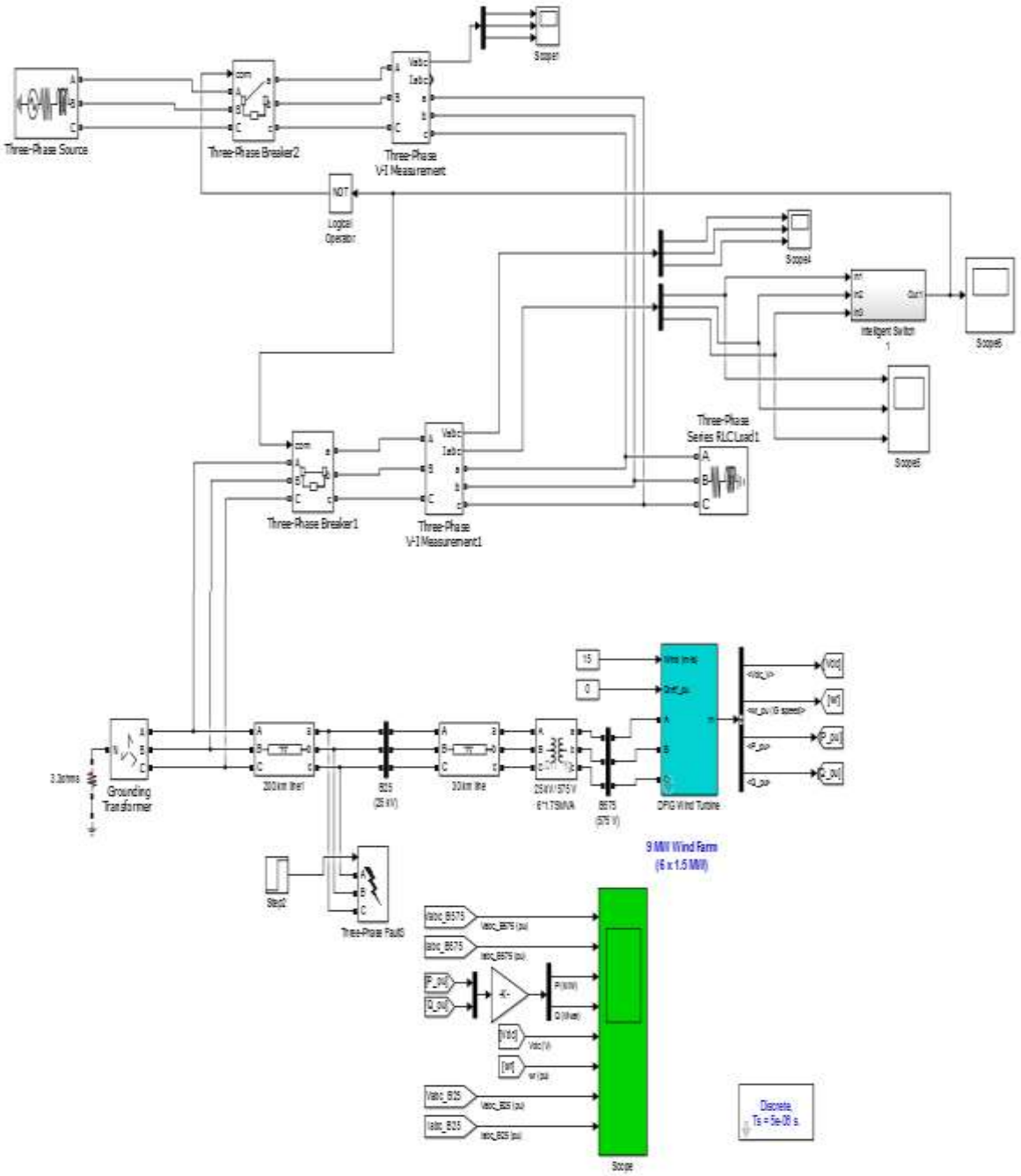
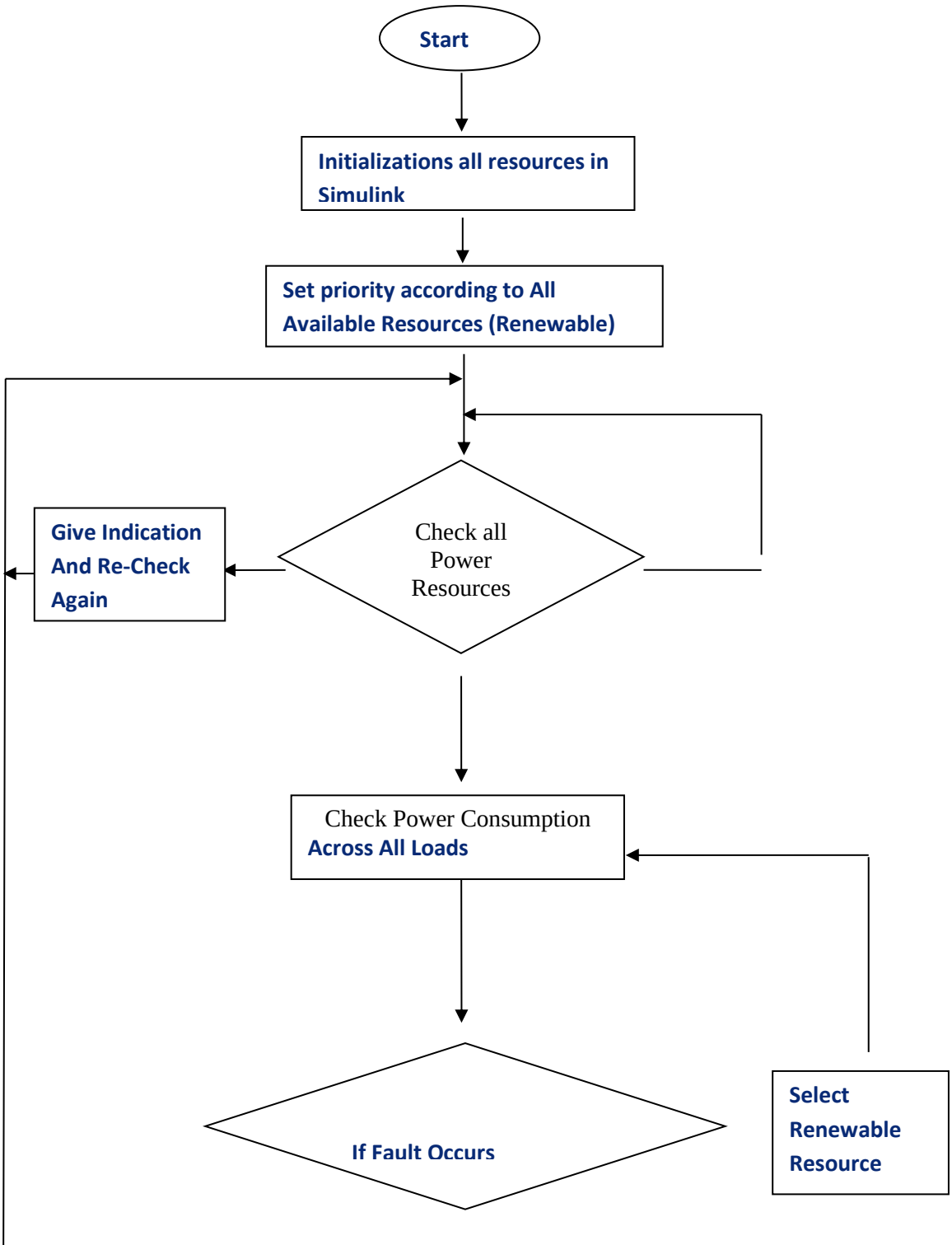


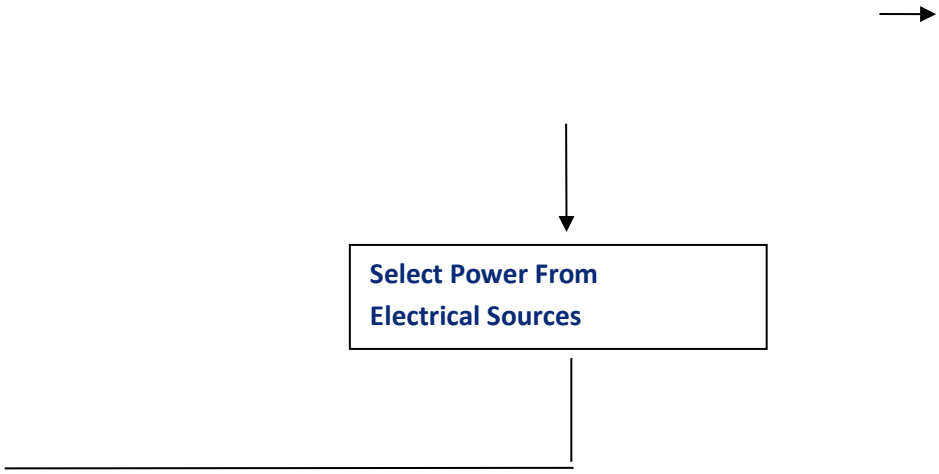
Fig 2: Simulated model of Smart Grid Power System using MATLAB / SimPowerSystem

Methodology:

1) Setup priority according to Renewable resources.
2) If the Renewable resource is not available, then select Non-Renewable sources. Like, solar power is not available, or wind is not available due to any reason.
3) Select, Power line according to load.

Flowchart





Results Achieved

The below various waveforms of Smart Grid with or without faults.

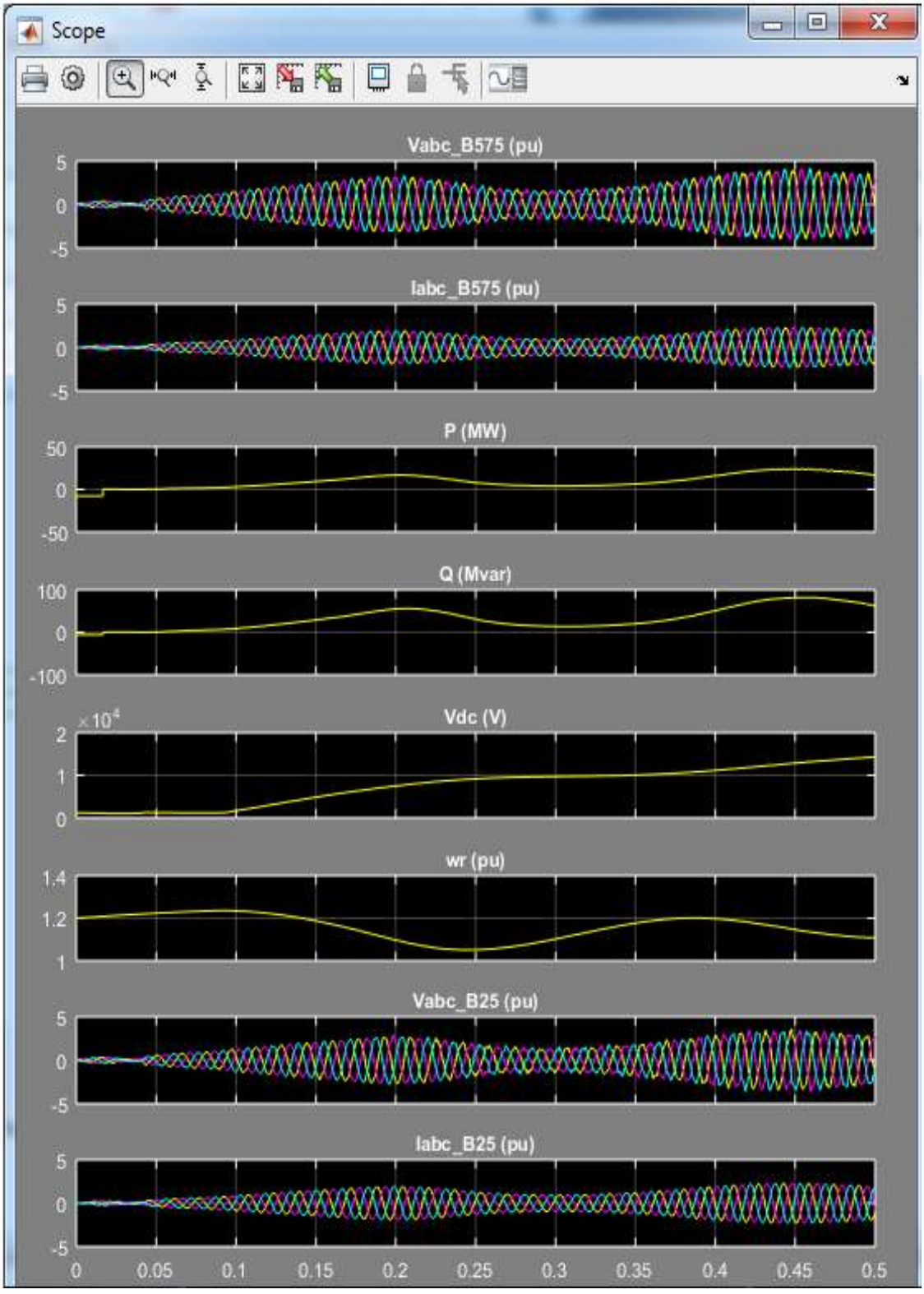


Fig 3: DFIG Waveform without Faults

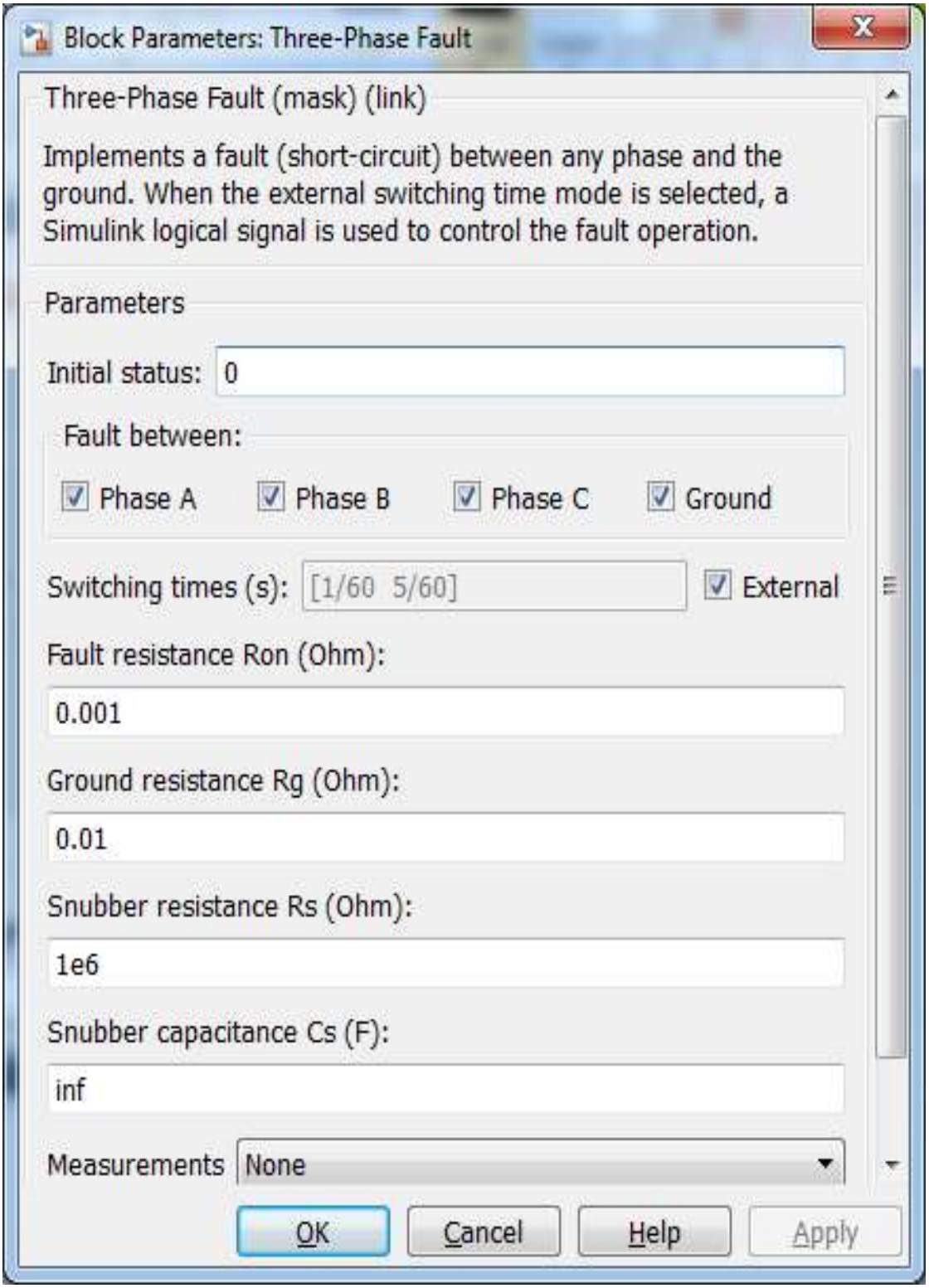


Fig 4: Fault Generation Block

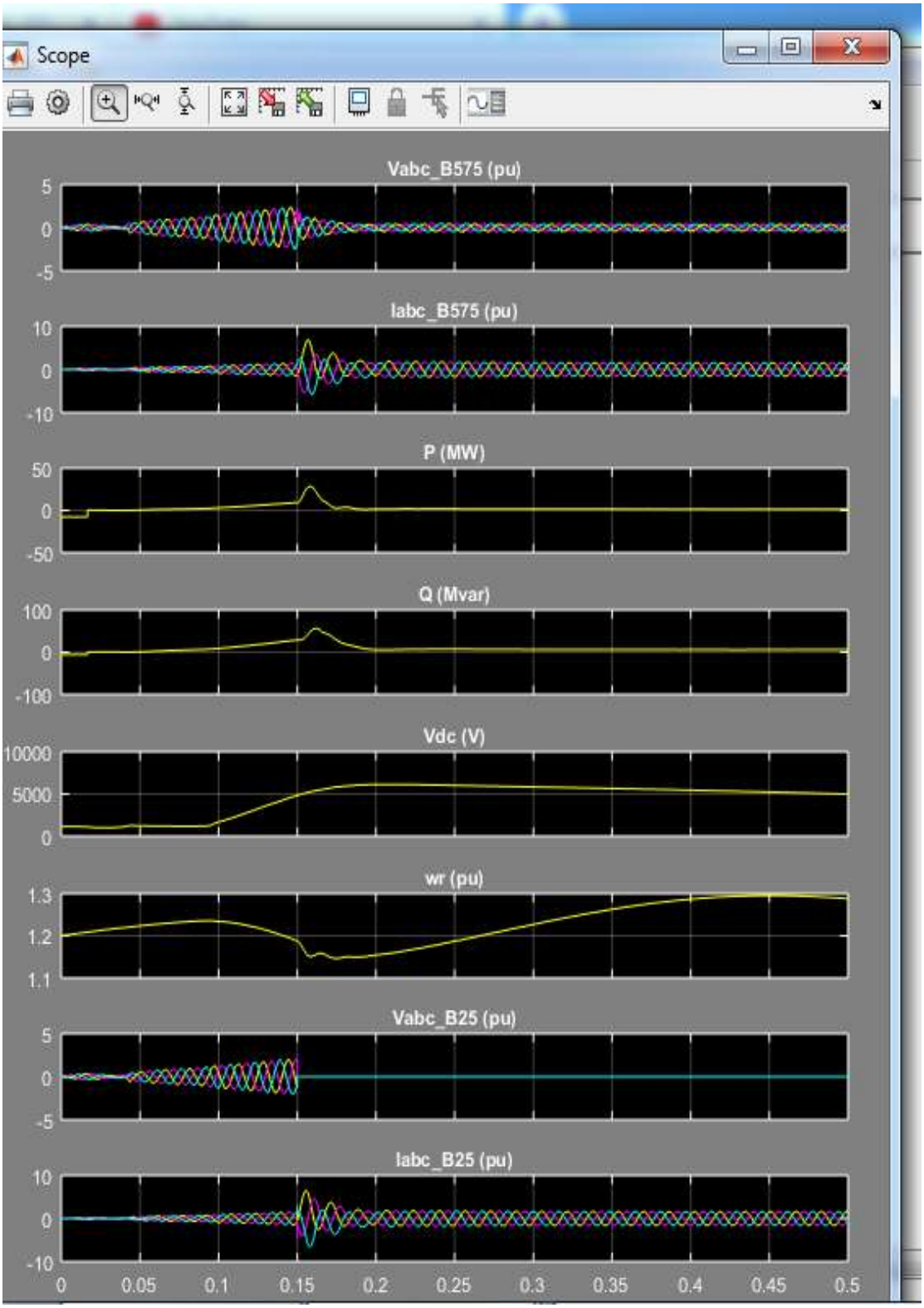


Fig5:DFIG Parameters and Step time after creating Faults

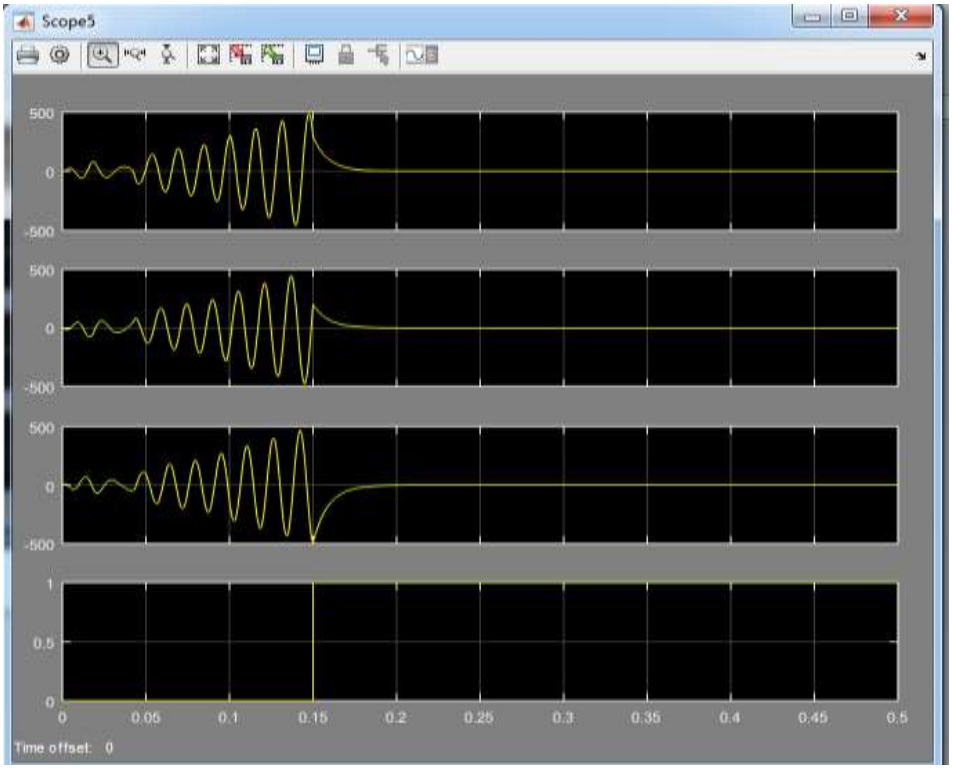


Fig6: DFIG Waveform after Faults

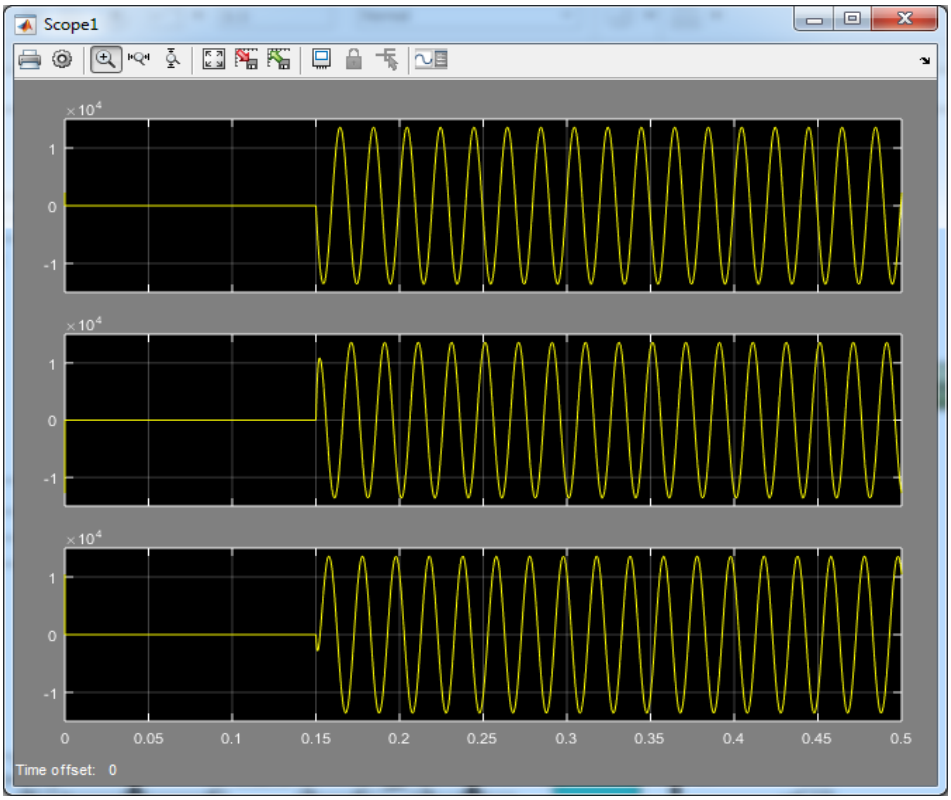


Fig7: Electrical Source parameters after creating Faults

Discussion

The smart grid is a modern electric power grid infrastructure, which smoothly integrates automated control, advanced sensing and metering technologies, modern communication infrastructure, and modern energy management techniques into the electric power grid.
This research is based on the ideal conditions through MATLAB, but in real-life scenarios to implement this will be challenging. The algorithms which control different functions in a smart grid are complex and need to be studied through simulation before actual implementation to ensure proper operation in all scenarios.
In this paper, proper utilization of power is achieved with a smart grid system with a non-renewable and renewable resource depending on load. With its full implementation, smart grids will make renewable power feasible and equip the grid to meet increasing energy demands by reducing both the cost of energy consumption and production.

Conclusion

The demand for Electrical energy increases day by day. Fortunately, over the last decades, there has been an increase in the availability and affordability of Renewable Energy Sources in households, such as windmills and, primarily, solar panels. Also, the capacity of electricity storage devices has risen considerably. As a consequence, this renewable energy production will make up a large portion of the energy in the electrical grid system. The traditional electrical grid needs to be upgraded into a smart grid system, which can work effectively and efficiently.
Recent research in the United Kingdom shows wind energy can be converted into electrical energy with the highest efficiency compared to other non-renewable and renewable energy sources.
In this work, the Simulink model is created and analysed in Matlab/Simulink. DFIG (Doubly Fed Induction Generator) uses wind energy as a renewable source and Three Phase Electrical Source as the non-renewable Electrical source. The faults are generated in between the transmission line towards the renewable source, the load received the supply from non-renewable Electrical Energy Sources, DFIG is disconnected with the help of three-phase circuit breakers respectively, and the load gets uninterrupted power supply.

Acknowledgment

With a deep sense of gratitude, we express our sincere thanks to the Innovation and Technology Centre of Engineering, Milton Keynes College, United Kingdom, for supporting this research.

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How Architectural Green-Planted Modules Can Play a Role as a Controller Against Air Pollution in Megacities

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Abstract
The purpose of this research is to propose a solution to the air pollution issue in megacities, which is caused by urbanization and overcrowded population through the use of architecture. Urbanization leads to air pollution because of the lack of greenery and the multiplicity of pollutants. When there is more air pollution, it warms the Earth. Drought and heat will destroy plants that have so far survived. As the cycle will repeat itself, now is the time to find solutions in different aspects of society to stop and decrease its harmful effects. I, as an architect and media architect, propose an architecture module, which consists of advanced technology and materials in conjunction with the concept of plant respiration. The new architecture item shall have the ability to be integrated with exterior walls. It shall be an improved version of green walls with the same goals but a higher efficiency and with fewer defects.
Key Words: Air pollution, Plant, Megacity, CO_2

1. RESEARCH QUESTION AND INTRODUCTION

According to IPCC (The Intergovernmental Panel on Climate Change), 2007, when CO_2 is released into the atmosphere, over 50% will take 30 years to disappear, 30% will remain for several centuries and 20% will last for several million years. These facts cause CO_2 to be regulated as a pollutant, and it is necessary to reduce carbon dioxide emissions worldwide.

The lack of greenery is observed around megacities, not only in the aesthetic aspect but also due to the potential of plants in decreasing air pollutions. According to NC State University, a tree can absorb as much as 48 pounds (21.7 kg) of carbon dioxide per year and can sequester one ton (907 kg) of carbon dioxide by the time it reaches 40 years old.

In terms of air pollution, cities are one of the most significant areas to consider because they always influenced by not only high level of air pollutions from traffic and industry, but also the demands of new migrants for new constructions, which release pollutants and destroy natural areas, which in turn also creates more air pollution. Hence, current megacities around the world require air purification solutions. This paper seeks to find how urban architecture and design can confront this problem. The most important question that this research attempts to answer is 'How Can Architecture Play a Role as an Air Purifier in Megacities?'

2. BACKGROUND

The first idea came from my personal experience of living in a polluted megacity. The importance of this issue and the strength of vegetation in air purifying is obvious to everyone.
I would like to introduce a project which is designed in my master thesis. The product as the result of this project is described as below:
The smart plant stand is a horizonal hexagonal box, of which the four side panels forming the hexagon and half of the front panel are made from transparent solar cells. The top side is open for the plant to grow. The bottom side is where the pot is located. The plant stand hangs from the backside to the façade of built areas in groups of as many as possible to help purify the air.
Each smart plant stand module possesses an Arduino Uno, which is a microcontroller, LED grow light, and water pumps. There are light sensors and moisture sensors, which analyse if the plant needs more lights and water, respectively. The energy for turning on LEDs and the water pump comes from the transparent solar cells that are provided on the sides of the box. The connection between all of these elements is based on IoT Technology and without the interference of humans.
The plants, which are chosen for this project, are rich in absorbing CO_2 based on NASA investigations. They are Japanese maple and Jade plant, which have red and green leaves, respectively. Using a combination of the plants could help increase the potential benefits.
I proposed this master thesis for Tehran since I had many investigations on its climate. Tehran is the capital of Iran and it is nominated as one of the most populated cities in the world.

Figure 1: Rendering of the module on façade of building

Figure 2: Prototype, Combination of Nature, Architecture and Technology

3. PH.D. PROPOSAL – "A PROPOSAL TO USE SMART PLANT STAND TO REDUCE AIR POLLUTION IN MEGACITIES"

All around the world, urban centres are becoming more numerous and increasing in size as more people move from rural areas in search of greater opportunities.

Nature has the capability to balance itself. In terms of air pollution, plant photosynthesis is proof of this fact. This research takes the potential of plants in absorbing CO_2 in architecture to help cities counteract the harmful effects of urbanization. But it is important to mention that, due to destruction of green areas via construction and the resulting global warming phenomenon, this delicate act has been thrown out of balance. What if architecture were to help this act as a mediator to balance it again?

The purpose of this research is to propose a solution to the air pollution issue in megacities, which is caused by urbanization and overcrowded population through the use of architecture. This Ph.D. research

takes architectures as ‘personas’ who have the duty of reduction and prevention in ‘scenarios’ relating to air pollution. Human-made structures cover a noticeable area of cities. This broad zone could be taken as an opportunity to create notable effects on society and human life. This is obvious that we cannot stop urbanization and over-constructed cities and it is not a trivial matter that the more we build, the more air pollution we release.
A wall is an architectural object, which is responsible for defining spaces by separating them. It also could be a filter between inner and outer spaces. Walls have other functions that can be added to its initial and classic meaning. In terms of heat, noise, light, and pollutions, walls could work as insulation. Exterior walls, which is also known as a façade, give the building its appearance. The exterior walls represent the face of buildings and their effect on the urban environment aesthetically and functionally. They give architecture its dignity. In addition to these responsibilities, a new function could be added to exterior walls with respect to air pollution. While green walls appear to be one possible solution to the problem of air pollution, it must be stated that green walls are not sufficient by themselves; many architects and building owners are not willing to cover facades with plants as they might have harmful effects on their environment regarding dirt, insects, allergies, etc.

3.1. The goals of this research state as below:
This research shall consider all aspects of existing green walls, evaluate the advantages and disadvantages, and investigate the amount of CO2 absorption through case studies of green walls using different kinds of plants and considering the efficiency; it is important to document current existing air pollution indices for use as an input and output more accurate statistical models.
The second goal is to improve upon green walls by transforming the concept into a module and introducing new methods of using them to improve their air purification capabilities.
An additional goal is to increase architects’ and owners’ enthusiasm of using this module on the façade of buildings. To achieve this, I need to use existing data and find out how it is possible to build a biotechnical module, which has an appropriate CO2 absorption capacity when compared to energy and cost requirements, which waste it produces, and a design that conforms to different wall shapes and acts as a module.

4. PROPOSED METHODS

The methodology of this research is based on investigation and consideration of existing sources. The majority of sources could be studied via libraries and available references.
The results of this investigation can be reproduced in laboratory and visualized using simulations and software. By laboratory I mean making a small semi real space with semi atmosphere of the world which has the potential to experiment the causes and effects of the proposed module on urban areas in a practical way and to use the result in improving the result of this research. The proposed module should be shown by prototyping for a better understanding the concept as a whole. The further investigations shall come in consequence of these methods.

5. EXPECTED OUTCOMES

This research aims to achieve effective cooperation between several elements in new ways, including new and pre-existing architecture as well as well-established technology that has not been purposed for this field along with new and emerging technologies. These new advancements shall also work conjointly with nature’s capabilities to solve the issue of air pollution using architecture.
The results of this study can be used to increase public awareness about the significant potential of green spaces to perform the function of air purification. In addition, a secondary objective is to cement the definition of the role of architects and architecture in relation to solving the air pollution issue.

The results of this research shall culminate in a final product, which is an advancement of the concept of green walls and shall be launched onto the architecture market as an essential component for use in architectural design alongside traditional elements and materials.

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Characteristics of Urban High-Rise Public Housing for Squatter Resettlement in Malaysia's Klang Valley

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Squatter settlements in Malaysia or perkampungan setinggan as they are locally known, have long been negatively stigmatised. Built using cheap materials, such as wooden planks and zinc sheets, this image is politically and morally unacceptable against an urban backdrop and is considered as backward (Bunnell, 2002:1689). In the 1980s, 90s and the early Noughts, Kuala Lumpur underwent rapid urbanisation and industrialisation which resulted in the major demolition of perkampungan setinggan to make way for new 'mega' developments. In 2001, the Selangor state government launched the Zero Squatters 2005 program. As a result, former squatter dwellers were relocated into low cost high-rise public housing, with little consideration of the consequences. This paper will discuss the characteristics of these public housing and how the relocation socially impacted the former squatter dwellers. Desa Mentari has been identified as a suitable case study for this research while its community were the main unit of analysis. Its selection was based on its characteristic, which is a neighbourhood for relocated former squatter dwellers that consisted of low-cost high-rise residential. The professionals and

authorities were the sub-unit of analysis, mainly for their professional perspectives and knowledge of the issues surrounding the community of this neighbourhood. The data was then analysed against the five domains of the Infrastructure of Everyday Life which are home and neighbourhood, sources of support, having a say, enjoyment, and making ends meet. Based on the analysis, the research found that the development of Desa Mentari only meets the minimum requirements or even less. The physical condition of the settlement has no quality and does not promote a healthy living environment. The bad design and inadequate facilities and services lead to frustrations, which then contributes to other social problems in the neighbourhood. The work ultimately argues that planning and housing policy should be informed by the everyday live activities and needs of specific groups within society. It suggests that, because the everyday life framework consists of five domains, it lends itself well as a tool for analysis of those needs and translation of that analysis into practical policy.

Multiple Statistical Testing, Mathematical Modeling of Pro-inflammatory and Anti-inflammatory

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The decision procedures with using systemic and anti-systemic comparisons, fractal and anti-fractal transformation have been studied and applied to cardiology. The purpose of this investigation was to propose and verify the algorithm for diagnosis of consumption inflammation syndrome. The object of study was included data of 72 patients with chronic ischemic heart disease, 25 – acute coronary syndrome, 27 – acute myocardial infarction, 152 – arterial hypertension. Methods: It was proposed and tested decision procedures for diagnosis of consumption inflammation syndrome by selective multiple testing by statistical and probabilistic analysis; conceptual spaces; graphic modeling; genetic algorithm. Graphic modeling for diagnosis of pathological processes is reduced to: analytical stage (analyses of subjective, objective and additional data); synthetic stage (search of system and anti-system complexes from the symptoms); incomplete formulations, in particular syndromes, including oxymoron; presentation of a diagnostic solution in the form of a diagnosis based on the search of fractal syndromes mechanisms, systemic focusing. Genetic algorithm for diagnosis of consumption inflammation syndrome included: using of conceptual spaces data; each person of population represents a variant of symptoms, syndromes; chromosome of this variant is composed from genes, where each gene is certain group of pro-gradient and anti-gradient symptoms, syndromes. It is necessary to continue of searching more typical combinations of symptoms and syndromes at the next stage of selection. Selection of following pairs is based on synergistic effects of pathology. After the selection of the optimal diagnostic solutions, it is necessary to check of selection quality. We had optimal making diagnosis decision in the patients with consumption inflammation syndrome by some mechanisms: changes of pro- inflammatory (foci with high inflammatory processes) and anti-inflammatory response (foci with marked anti- inflammatory effects); formation of a set of primary and secondary centers of consumption: one – anti-inflammatory factors, others – pro- inflammatory; activation and blockage of cells membranes stabilities, lipolysis, phospholipolisis, intravascular and different tissues' activities of cells (neutrofiles, monocytes, T and B lymppocytes, platelets) and plasma factors of blood (cytokines, pyretic proteins). Consumption of basic substrate of pro- and anti-inflammatory factors contribute complicated course of disease, concomitant deterioration of age-dependent diseases. Using systemic and anti-systemic comparisons, fractal and anti-fractal

transformation by selective multiple statistical and probabilistic analysis; conceptual spaces; graphic modeling; genetic algorithm, graphic modeling of mechanisms allows to improve the possibilities of individual diagnostics. Concluding procedures for diagnosis of consumption inflammatory syndrome gave us higher level of sensitivity and specificity.

Evaluation on Tree Canopies Shading Performance on Solar Heat Stress of Building Walls in Tropical Climate

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In hot tropical climates such as Malaysia, excessive solar radiation is one of the most critical issues in building and environmental design. The solar radiation that passes through the building reduces the comfort level of people and also increases the number of energy consumptions such as electricity and fuel, which will increase the amount of carbon footprint. One of the alternatives to control solar radiation is to apply passive design by using natural planting system. However, the shading effects from the tree canopy forms are yet to be explored. Thus, this research studied the tree canopy shade performance in four different trees canopy form, i.e. round, oval, spreading and irregular-vase. Moreover, this study compared the percentage of shade at different times of the day and distances from the west side of the building wall. The selected species in this research were based on certain criteria from tree height, the density of canopy, canopy form, size, the arrangement of the leaves and availability of species at a chosen location. The selected species are namely, i.e. i) *Cinnamomum verum* (Cv), ii) *Diospyros blancoi* (Db), iii) *Dalbergia Oliveri* (Do), iv) *Bauhinia Purpurea* (Bp). The research was conducted in four steps of method - i.e. (i) Photographic method, pictures taken from trees for 3D model making; (ii) measuring and calculating the percentage of light filtration (PLF) and transmissivity; (iii) computer simulation software to calculate the percentage of shade on the solid walls at different timeline, (iv) computer simulation software to calculate solar radiation stress on the west wall. The findings found that *D.blancoi (Db)* and *C.verum* (Cv) have the highest amount of PLF out of four chosen species, respectively, due to high canopy density, compared to *B.purpurea* (Bp) with the lowest amount of filtration. Besides, all four species have a maximum shade effect when there are planted at 3-meter distances from the west wall. Significantly, the second-lowest amount of PLF or highest amount of solar transmissivity occurred from *D.oliveri*, which has the highest percentage of shade and lowest solar heat stress on the west wall due to the form of the canopy, branches and angle of leaf surfaces. Also, shade performance obtained from cluster trees (zigzag arrangement) experiment was used to validate the functionality of this research.

Evaluation of Native Plants Material on Solar Radiation Filtration Effectiveness by Using Microclimatic Properties Assessment

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The urban air temperature rise has the various environmental impacts to our society such as abnormal heatwave and thermal stress. This phenomenon is much worsening in the tropical climate, and this condition will influence the outdoor energy budget, leading to an increased urban heat island effect (UHI) and human discomfort. One initiative by the Malaysian Government under the National Development Policy (2013) as measures to combat climate change, environmental problems and improve the societal well-being of city dwellers. It is highlighted in the planning of Low Carbon Cities (LCCs), tree's physical properties are one of the essential elements in mitigating UHI. Nevertheless, the focus on the current city planning particularly in trees physical properties is not sufficient to alleviate UHI. Hence, lacking study in assessing the potential of microclimate properties of urban trees in minimizing the environmental impact of excessive radiative heat is vital to be evaluated. The ability of trees to improve tropical outdoor environments focus on the reduction in downward energy flow, particularly of visible light and solar infrared waves. Thus, this study aims to evaluate solar radiation filtration effectiveness of native tree species using field measurement and data gathering in providing a new compilation of tree microclimatic properties assessment for the benefit of the urban environment. The research methodology was conducted in three phases – i.e., (i) Tree Sampling Selection; (ii) Field Measurement Program; and (iii) Analysis Program. The outcome of tree species types and radiation filtration competency will enhance the existing trees physical properties database. The finding shows that types of native species are capable of altering heat of solar radiation up to 98% of total heat gain. In this case, the ability of these species to moderate microclimate and improve radiation heat gain are significantly higher. This knowledge is essential to aid urban designers in choosing the right kinds of tree species. It will also act as an additional planting material guideline by upgrading the existing LCCs framework predominantly in ensuring sustainable development through the conservation of the natural environment.
Keywords: Native Plants, Solar Radiation Filtration Effectiveness, UHI Mitigation, Heat reduction, Tree canopy.

The Cultural-Creative Industries of Uttarakhand (India): Specific Focus on Interior Architecture and Space-Making (Building) Crafts

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This paper is an attempt to document and discuss the cultural-creative industries of Uttarakhand (a Himalayan state of India), with a specific focus on interior architecture and space-making (building) crafts. According to UNESCO, the cultural-creative industries refer to the creation, production, and distribution of goods and services that are cultural in nature. The cultural-creative industries generally include text; music; television; film production and publishing; crafts and design; architecture; the visual and performing arts; sport; advertising; and cultural tourism. Uttarakhand is a cultural hub, and is home to unique and exquisite forms of cultural-creative industries such as aepan (ceremonial floor and wall paintings), tamta (copper craft), ringaal kaam (bamboo craft), likhai kaam (wooden carvings), stone craft, wood craft, natural fibres, textiles, candle making, and indigenous architectural styles. This paper specifically emphasises on the aepan paintings and the wood crafts (especially the likhai kaam) seen in the traditional residences of Uttarakhand (at least 250 years old). It further focuses on establishing the importance of documenting and archiving these craft forms with an emphasis on the quintessential role played by them in space-making – at the surface level; structurally; and, as an object (both utilitarian and decorative), by developing a conceptual framework and methodology for such analysis. This is primarily a deductive research which employs a case study-based approach. It is inter-disciplinary in nature, and focuses on interior architecture; craft; and, culture with an intention to develop repositories and disseminate this knowledge. It may be of interest to several students, researchers and professionals from varied backgrounds.

Keywords: Cultural- Creative Industries; Interior Architecture; Space-Making Crafts, Uttarakhand, India

The Evolution of International Posture in Japanese EFL Students from Grade 10 through University 2nd Year: A Longitudinal Study

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The development of English proficiency of EFL learners is concurrent with the development of international posture, one's proclivity to relate oneself to the general international community (Yashima, 2009). In Japan, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) has long focused on expanding English education to prepare students for the realities of an increasingly globalized world with an extensive program that integrates native speakers of English into the school system for grades 3-12. The focus of English education, however, changes over time from a markedly communicative focus in elementary school to the less communicative, grammar-focused junior high interval and then to test preparation in high school. Upon matriculating, the focus returns to communication. Against this shift in focus over these dozen years, the goal remains to instill some level of English proficiency and to cultivate internationally-minded students. For the latter goal, the construct of international posture serves as a reasonable proxy for assessment purposes, yet its configuration over time has received little attention. To illuminate the evolution of international posture over the latter half of this period (i.e., from high school through the first two years of university), the current study utilizes latent growth curve (LGC) modeling, a seldom-used approach in EFL research in Asia. Results suggest that international posture becomes a partially invariate trifurcate construct over this 5-year interval and that the levels of the respective facets comprise two distinct splines, first declining in tandem during high school and then rebounding slightly during the first two years of university. These results provide insight into the precise behavior and measurement of international posture, an important complement to the

growth of English proficiency of EFL learners. Furthermore, this study adds to the limited literature on LGC modeling in Asian EFL contexts.

Bayesian Networks for Assessing Mobile App User Behaviour

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Understanding customer behavior is extremely important to any company. Better understanding of customer behavior will also allow the companies to introduce appropriate options to stimulate a desirable user behavior. We develop modeling strategies to model complex user behaviors of mobile app users to gain a deeper understanding of customers using Bayesian networks, their predictive models and learning algorithms. Bayesian Network is a junction of Graph theory and probability. Specifically, it is a directed acyclic graph containing nodes and directed arcs. Among them, each node represents a variable and the arcs between variables show some dependencies. Then a Bayesian Network uses conditional probability to quantify the dependencies of variables. Along with this, we can do some inferences according to these conditional probabilities, which means that we can obtain an approximation of possibility of an event under several conditions. Furthermore, Bayesian paradigm also allows us to encode our prior beliefs about what these predictive models should look like, depending on what the data tell us. As for problem above, Bayesian Networks work better especially describing relationship among different customer attributes variables. We also consider various learning algorithms for structure learning of Bayesian Networks in order to assess the dependence and behavioral relations in data. The methods will also allow predicting the probability of leaving any new or existing customer given his/her past data. This is important for identifying the customers who are about to leave the service, based on their actions and take appropriate remedial measures. These methods will also facilitate the behavioral clustering of customers and user churn prediction in order to better understand the health of the business. The methods will be tested on over one million records of structured, unstructured and multidimensional data available from a mobile app developing company's current and past customers. We then aim to develop a software platform to make it usable for decision makers of the company to assess the customers without any analytics knowledge. The software will also allow the users to track their progress and collect merit points given by the company that can be redeemed for future use without complex analytic knowledge.

Listeners

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