IEEE UET

June 2021
"Vol. 3,No. 2"

ELEKTRON

A Publication of Department of Electrical Engineering
University of Engineering and Technology Lahore
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MESSAGE FROM THE VICE CHANCELLOR

University of Engineering and Technology Lahore is an institution which has always nurtured its students to set and achieve lofty goals by providing them the freedom to polish their skill set through curricular and co-curricular activities. A commendable product of such efforts and skills is Elektron, a magazine by the Department of Electrical Engineering, produced by the Student Chapter of IEEE, UET Lahore. Elektron reflects the creative minds of the students of Electrical Engineering and their abilities to breathe life into their innovative ideas.

To make this magazine a constant source of guidance and inspiration for the masses, the work done by the team Elektron is indeed worthy of appreciation. The efforts put forth by the team Elektron should serve as a motivation for other students of UET Lahore to embark upon similar initiatives. I wish them best in their future endeavors.

Prof. Dr. Syed Mansoor Sarwar,
Vice Chancellor,
University of Engineering and Technology Lahore.

MESSAGE FROM THE CHAIRMAN

“

Universities have always been the centers of research and development since the known history of knowledge. Students get inspired from their teachers in the learning environment of universities and the motivation of getting published gives oxygen to the spark of the competent and enthusiastic students. Departmental magazines provide teachers and students a platform to present their research, innovative ideas, and their observations and comments on existing research.This opens a gateway to the junior students towards the horizons of knowledge.

IEEE UET Elektron magazine, which is a publication of the Department of Electrical Engineering of UET Lahore, is one such platform.

I wish the best of luck to the hard working team of the magazine from Department of Electrical Engineering and IEEE UET Lahore.

”

Prof. Dr. Khalid Mahmood ul Hasan
Chairman, Department of Electrical Engineering
University of Engineering and Technology, Lahore.

MESSAGE FROM THE EDITOR IN CHIEF

“

In Pakistan, the students at the pre university level are often curious about opting their areas of professional education. However, it is observed that the students at those levels do not have access to the relevant knowledge to help make their minds taking suitable decision.

Electron magazine is an effort of the department of electrical engineering of UET Lahore, to remove this knowledge deficit of the pre university students. Specially, this magazine is an attempt to provide some knowledge to both the foundations and advances of the domain of science and engineering, in general and electrical engineering and its applications, in particular. Link among religion, philosophy and science is another relevant area of study, published under the scope of this magazine.

Other than helping pre university students, Elektron is also publishing articles to enhance the knowledge of early semester students of electrical engineering, professional scientists, engineers, specially, electrical engineers, and of the other readers interested in learning and knowing about foundations and advances of science and engineering.

This issue of electron invited the articles with very broad scope, but the preferred areas of interest for this issue were, but not limited to

- Religion and Science
- Contribution of Muslims in the Field of Science
- Science and Philosophy (a union)
- Technical Innovations in Electrical and Electronics Engineering
- Engineering Mathematics
- Engineering Protocols and Ethics
- Engineering Book Reviews
- Works of a Renowned Researcher
- Engineering Case Studies

I hope that, the readers find the articles of this issue worth reading.

”

Muhammad Salman Fakhar
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VERSE *“11”*

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فَافْسَحُوْا يَفْسَحِ اللّٰهُ لَكُمْ ۚ وَاِذَا قِيْلَ انْشُزُوْا فَانْشُزُوْا
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دَرَجٰتٍ ۗ وَاللّٰهُ بِمَا تَعْمَلُوْنَ خَبِيْرٌ ﴿١١﴾

“O believers! When you are told to make room in gatherings, then do so. Allah will make room for you ˹in His grace˺. And if you are told to rise, then do so. Allah will elevate those of you who are faithful, and ˹raise˺ those gifted with knowledge in rank. And Allah is All-Aware of what you do.”

”

Figure Source: https://www.pewresearch.org/

Article 1

Metaheuristic Optimization Algorithms

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Abstract — One of the core objectives of engineering are to find optimal solution to several daily life mathematical problems. There can be several types of optimization problems that can be found in literature produced in history of engineering and mathematics. Depending upon the nature of optimization problem, there can be different types of optimization algorithms that can be used. Not every algorithm is suitable for every other type of optimization problem. This article is the second of the series of articles on introduction of Engineering optimization, to be published in Elektron Magazine. The first article was Engineering Optimization: An Introduction to Some Classifications of Engineering Optimization, and now this article presents an introduction to a class of optimization algorithms, known as metaheuristic optimization algorithms, used to solve complex optimization problems.

Keywords — Optimization, metaheuristic optimization algorithms

INTRODUCTION

According to reference [1], depending upon the nature of optimization problem, there can be different types of optimization algorithms that can be used. Not every algorithm is suitable for every other type of optimization problem. Primarily, the optimization algorithms fall under two major categories: deterministic and stochastic. Deterministic algorithms follow a fixed procedure and protocol, and their trajectory of search is redundant whenever they are applied on one type of optimization problem, i.e., the results occur repeatedly the same if the starting states of optimization procedure are same. Examples of such algorithms are hill climbing, Newton based algorithms, gradient search etc. Stochastic algorithms, as their name depict, always include some sort of randomization process in their approach towards finding solutions to optimization problems. Swarm based metaheuristic algorithms like Particle Swarm Optimization and Firefly Algorithms are good examples of stochastic algorithms. They start with generation of set of solutions and these solutions update their states iteratively to converge to the optimum solution. Due to randomness in the procedure of these algorithms, it is usually very less likely to repeat the whole trajectory of the optimization process. It is also possible to develop algorithms that have both deterministic as well as stochastic nature in the iterative update process of finding solution. Swarm based algorithms and genetic algorithms usually have both deterministic as well as stochastic behavior in the solution update process and usually it is convention to consider them under the category of stochastic algorithms. Another suitable example of hybrid type algorithm is to start hill climbing algorithm with different initial points. Figure 1, taken from reference

[1], presents general layout of types of optimization algorithms.

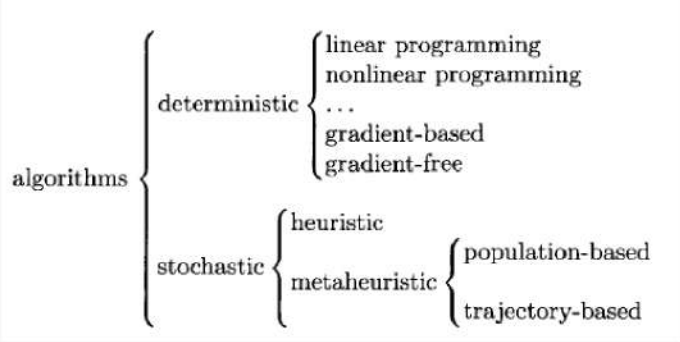

Figure 1. *Classification of algorithms, taken from reference [1]*

METAHEURISTIC OPTIMIZATION ALGORITHMS

Metaheuristic optimization algorithms are relatively latest types of optimization algorithms which use both stochastic and deterministic approach to find good approximates of global optimum solution of an optimization problem. These algorithms are usually inspired from some or the other phenomenon of nature, e.g., food search behavior of birds, fish, the evolution process of living beings, the attraction and repulsion behaviors of species within their kind, the genetic mutation process, the water cycling process of nature and many more natural phenomena. Genetic algorithms, evolutionary algorithms, swarm algorithms, all fall under the category of metaheuristic optimization algorithms.

According to reference [1], In every metaheuristic algorithm, two main components will be: randomization and selection of best solution for proceeding towards next iteration of the iterative search process. The selection of best solution within an iteration ensures that ultimately, after the completion of iterative process, the solutions will converge to a good approximate of global optimum solution whereas the randomization process hinders the solutions to stick to any local optimum of the solution space and increase the diversity of solutions [1],[2].

Metaheuristic algorithms can be further classified into two major types. Trajectory based, like simulated annealing algorithms starts with generation of only one solution (starting point), that follows some rules and protocols to update its position to make a trajectory to ultimately reach towards a global optimum. On the other hand, the type is population based, like particle swarm optimization, in which several solutions are randomly generated which follow an iterative procedure of updating position to ultimately converge to a global optimum solution [1], [2]. Figure 2 and figure 3 give the representation of trajectory-based algorithms and population-based algorithms respectively.

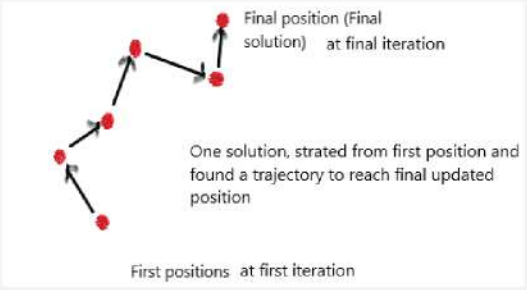

Figure 2: *Working of trajectory -based algorithms . They utilize only one solution at start proceeding serially to the final best solution at last iteration.*

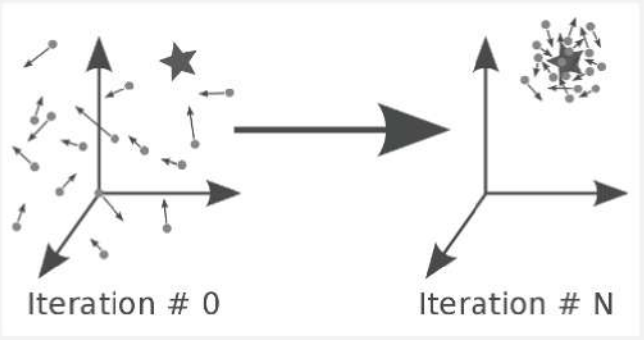

Figure 3: *Working of population -based algorithm (Particle Swarm Optimization in this example figure). They start with a population of solutions at first iteration , and each particle moves to new location , ultimately all solutions converge to the best solution. Figure taken from reference [3].*

NO FREE LUNCH THEOREM

According to references [1], there is no ultimate and universal algorithm that can solve every other optimization problem with same efficiency, and there is no guarantee that an algorithm will always find global optimum solution in global optimization problems. For some type of problem, if one algorithm has given best possible solution does not mean that it will be giving best solution for every other type of optimization problem. In fact, according to reference [1], if and algorithm A has outperformed algorithm B for one type of optimization problem, then for some other optimization problem, algorithm B will outperform algorithm A. These theorems are known as “No Free Lunch Theorems”.

No Free Lunch Theorem then demands that it is impossible to state that one algorithm will work equally well for every other type of problem and it can be said that for every type of optimization problem, we can find that if an algorithm is giving a robust solution, if not the best solution for a few types of optimization problems within a domain or not.

WHERE TO START FROM?

A potential and interested researcher in the field of optimization can start by exploring the following two points.

1. What are different classes of optimization problems?
2. What can be different conventional or metaheuristic optimization techniques that can help solving those optimization problems.

Reference [1], is a good book to start with, as a student of engineering optimization.

NEXT TO COME

The next article of this article series on optimization will discuss several types of applications of optimization theory and optimization algorithms in the domain of electrical engineering and will discuss how a potential researcher can start working in this wonderful domain of electrical engineering optimization.

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Figure Source: https://www.generalkinematics.com

Article 2

Charging Plug-in Hybrid Electric Vehicles

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Abstract — Since the last decade, there has occurred major changes in transportation due to large scale emergence of plug-in hybrid electric vehicles (PHEV) and plug-in electric vehicle (PEV). PHEVs/PEVs can be charged in two locations i.e., (1) home and (2) public charging stations. In public charging stations, there can be a risk of overloading when several thousands of PHEVs get connected to stations for charging over a short period of time. Thus, there should be some intelligent load management system which allocates power efficiently to all the connected vehicles. This can be done by optimizing the power supplied to these vehicles. This article presents an overview of some of the advances in the optimal management of charging Plug-in hybrid electric vehicles and Plug-in electric vehicles.

Keywords — Intelligent load management, Plug-in electric vehicles (PEVs), Plug-in hybrid electric vehicles (PHEVs)

INTRODUCTION

In public charging stations, there can be a risk of overloading when several thousands of PHEVs get connected to stations for charging over a short period of time. Thus, there should be some intelligent load management system which allocates power efficiently to all the connected vehicles. This can be done by optimizing the power supplied to these vehicles [1]. For this, there is a need to formulate objective functions according to customer's requirements (energy demand, energy price etc.) and maximum available power from station. The aim of this research area is to maximize the objective function, mainly the state-of-charge of each vehicle.

Due to ever-increasing demand of these PHEVs, there can be a risk of overloading of charging grid in public charging stations [1]. So, there is a need for proper manipulation of power available from grid and the power demand by vehicles [2]. As, there will be variation in power demand by vehicles at different time so, grid would have to intelligently allocate power to the connected PHEVs [3].

State-of-charge is one of the main parameters to be optimized to efficiently charge the vehicles [4]. References [2], [5] applied metaheuristic optimization algorithms like PSO and APSO to solve this optimization problem.

PROBLEM FORMULATION

Energy price, energy demand and total power capacity of charging station are the main factors to be considered in smart charging of Plug-in Hybrid Electric Vehicle (PHEV). For an efficient system, it is required that each PHEV should be charged in time less than the estimated charging time. As mentioned previously, the State-of-charge is the key parameter to be maximized to allocate the power proficiently. The constraints are; time required for charging a vehicle, current state-of-charge and market price of energy. Objective function is the summation of product of two terms of each vehicle. First term is the weighting term of charging of each vehicle, at a certain time step "k", that is a function of present state-of-charge, energy price and charging time and the other term is the state-of-charge of each vehicle at next time step (k+1). This is given in equation (1) to equation (3). The battery model can be represented as a capacitor circuit and after substituting capacitor model voltage, current and power equations, the

final form of objective function will become as given in equation (5) [2].

$$Max\ J(k) = \sum_i w_i(k) SoC_i(k+1) \quad (1)$$

$$w_i(k) = f(C_{r,i}(k), T_{r,i}(k), D_i(k)) \quad (2)$$

$$C_{r,i}(k) = \left(1 - SoC_i(k)\right) * C_i \quad (3)$$

$$SoC_i(k+1) = SoC_i(k) + \frac{I_i(k)\Delta t}{C_i}$$

$$J(k) = \sum w_i * \left[SoC_i(k) + \frac{P_i(k)\Delta t}{\frac{1}{2} * C_i * \left[\sqrt{\frac{P_i(k)\Delta t}{0.5 * C_i} + V_i^2(k)} + V_i(k)\right]} \right] \quad (4)$$

(5)

Here,
k is the time step,
i is the no. of PHEV plugged into the station,
w_i(k) is the charging weighting term,
SoC_i(k+1) is the state-of-charge of i^{th} no. of vehicle
$C_{r,i}$(k) is remaining battery capacity of i^{th} number of vehicle at time step k as shown in Figure 1 ,
C_i is rated battery capacity of i^{th} no. of vehicle,
$T_{r,i}$(k) is the remaining charging time required for i^{th} no. of vehicle,
D_i(k) is the difference between real-time energy price and the price at i^{th} no. of vehicle owner is inclined to pay,
Δt is the time period defined by operators of charging station,
I_i(k) is the charging current which is assumed to be fixed over time period,
C_i is the capacitance of i^{th} vehicle battery in Farads.

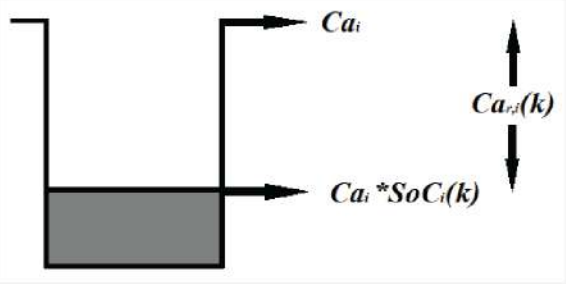

Figure 1. *Battery charging illustration, taken from reference [2].*

In this problem, the main energy constraints are the total power that a charging station can give and the maximum power that can be absorbed by any vehicle. The power demand of any vehicle should not exceed the output power of charger in station. The station efficiency denoted by η is constant for any time step and SoCi,max is the ith vehicle's battery's maximum SoC limit. To avoid overcharging, when SoCi becomes equal to SoCi,max, then battery charger switches to stand-by mode until next vehicle battery is plugged-in. [2]

SOLUTION METHODOLOGIES

The aim of this research area is to maximize the objective function, mainly the state-of-charge of each vehicle. The goal is to get the global optima (maxima) for the objective function given in equation (6) using optimization techniques in less computational time and a smaller number of iterations. References [2] and [5] have solved these problems using particle swarm optimization and accelerated particle swarm optimization, that are very efficient metaheuristic optimization algorithms. Algorithms that give global optimum solution will be effective, but the efficient algorithm will be the one which will give global optimum solution in a smaller number of iterations and have high computational efficiency.

CONCLUSION AND FUTURE SCOPE

This article introduced the area of optimal management of charging PHEVs and PEVs and presented some of the works of research that is done in this area. Since the SOC optimization is highly non-linear and multi-modal optimization problem, finding its optima is still an open-ended problem and there is a need of designing or finding optimization algorithms that find good approximates to the global optimum solutions of this problem, both for the benchmark test cases and also for the real time practical SOC optimization problems at the physically existing charging stations.

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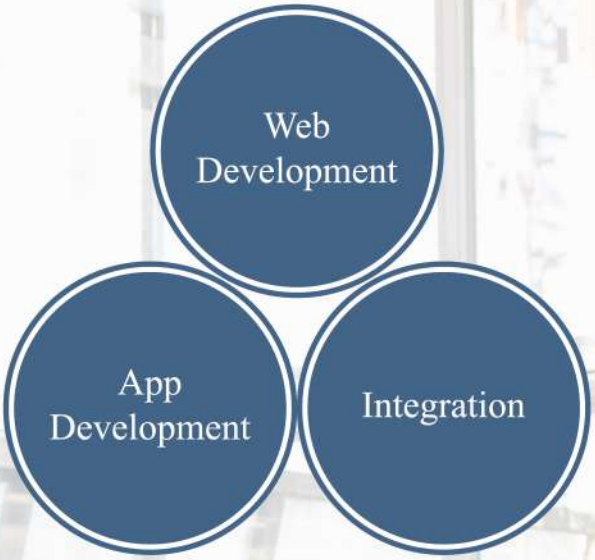

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Article 3

Creation of greener Power Adaptors

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Abstract — At present, most of the electronic devices get powered by power adaptors that are particular to that appliance. Unluckily each appliance has its own current and voltage specifications, which points to the build-up for a power adapter that is dispensable and appliance specific. Nevertheless, we could make a power adapter that comprises of multiple ports and can provide power to a range of devices, having various power specifications. To vigorously fulfil the requirements of the appliances that are connected to the smart power hub, a digital connection between the appliances and the smart adaptor is vital. This article presents the review of work done related to the smart adaptors and the application of it in monitoring and controlling power for different devices after a communication is established. There environmental impact, life cycle assessment (LCA) and End of Life (EOF) scenarios are also discussed in this paper.

Keywords — Electric Power Supplies (EPS), Life Cycle Assessment (LCA), End of Life (EOF)

INTRODUCTION

Many times, we need to replace our perfectly working external power supplies because we no longer use the products powered by them. The reason is the dedicated power specifications of different products we use that are not suitable with each other. That is why we cannot reuse the power supply of one product that is broken for the other that is replaced with the broken one. Wasting of all these functionally perfect power supplies leads to a total loss and it's done in almost after every two years, contributing to a significant number of EPS being thrown away. To get rid of this unnecessary wastage of EPS we need a power interface that is suitable to charge any electronic device using a smart power adaptor.

The EPS are also unable to control the changing state of the electronic products they power, which indicates that the energy is wasted when there is no need to supply power, this state of an electronic product when it does not require power

is known as standby or vampire power drain [1].

When we analyze the energy wastage in the standby state in the process of production, packaging and shipping of a one-time-use power adapter , it makes you think why these things are going this why.

There are billions of power supplies that are made every year because of their design specifications for one particular device and no functionality for other devices. The shocking amount of external power supplies developed and disposed in 2008 are displayed in Figure 1.

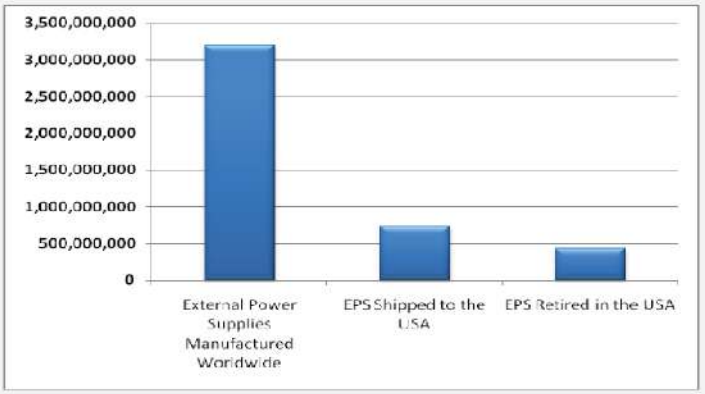

Figure 1. *The resulting waste because of the non-interoperable EPS are displayed in units [1]*

A smart power adaptor can dynamically adapt the output voltage and current specifications of multiple devices on real time. This smart adaptor could also bridge communication between the user and the device, by real time monitoring and controlling of load using the smart adaptor.

From the past several decades research has been done to decrease the greenhouse gas (GHG) emissions, which are the major cause of drastic climate change and global warming [3]. There are specific energy conversion devices for each product that are not suitable for the other product and there manufacturing causes a huge amount of energy loss. To build an energy efficient power adaptor that will contribute to reducing the GHG by not only decreasing the production of power specific adaptors, but it will also reduce the amount of energy consumed in standby state of a device, by monitoring the controlling an electronic device in that mode. According to a survey on developed countries that is conducted by International Energy Agency (IEA), this energy loss because of standby state of devices is 10% of the total household electricity consumed.[2]

There have been many efforts done in the past to standardize the voltage used by DC-powered devices, but there are two limitations associated with them. The first is that every device has an optimal voltage requirement, and it will not work outside that range, secondly a standardized set voltage that does not possess the ability to negotiate maximum output power will end up providing too much or too little power to a product connected with it. On the other hand, universal power supplies have recently been very famous products. Their architecture depends on three methods to set the voltage statically to match the voltage of the device connected with it. The methods are:

a. Manually selecting the switch
b. Sensing the power supply's resistor value that is unique for each electronic product, which makes the power adaptor to choose an appropriate output voltage.
c. Voltage sensing ability where the power adaptor could sense the required voltage of the device connected to it.

But the problem here is that there could be a probability of setting a manual switch incorrectly, and the other two methods although results in few errors but are proven to be inconvenient, as they work on managing the product specific power supplies. And most importantly these methods work statically, and the output voltage is set initially, so these universal adaptors are not able to dynamically adapt the varying conditions of the electronic devices connected to them.

One way to make EPS, dynamically adapting the power requirements of digital products is to implement a digital protocol that facilitates the communication between the devices and their chargers. Moreover, this collaboration of device and the power supplies can make a way to develop a new power application, that is not feasible using the conventional power model mentioned previously. Like such a powered device could also let the power supply know about the state of the device that whether it needs to get powered or not, so basically it could tune the power supply for its changing mode. And this also facilitates in saving the extra power consumption that is not needed by the device standby state. Smart power applications have endless possibilities that are now being analysed [1].

Green Plug are the manufacturers of digital products, that can provide real time communication between the electronic products and their power supplies. They offer customers to purchase Greentalk-enabled smart power adaptors. These smart power adaptors adapt the power specifications of the devices connected to them and reduce the no-load and standby power consumption automatically. Green plug claim that they have made a Greentalk protocol and Greentalk interface in order to decrease the amount of incompatible power supplies manufactured and disposed yearly. They also reduces the amount of the energy consumed by the devices when they are powered on but not in use. This digital technology also favours the production of a single adaptor with multiple power interfaces, to power multiple devices in one time[4]. IDevices introduces an indoor/outdoor smart adaptor that builds communication between you and your appliance, which makes any device you plug into it a smart device. this smart adaptor will notify you about the usage of your device and possess the ability to turn it on and off [5].

LIFE CYCLE ASSESSMENT

Life cycle Assessment (LCA) of a device or system or is a way to measure its environmental impacts over the period of its respective lifetime. It provides a framework to look over miscellaneous manufacturing approaches and techniques related to the products and processes, aiming to give a comparison that which one is more efficient or environment friendly. To investigate all features effecting the environmental sustainability, energy-based Life cycle assessment is a substantial tool to investigate [6]. Figure2 Illustrates the various Energy Life cycle assessment phases of an electronic product.

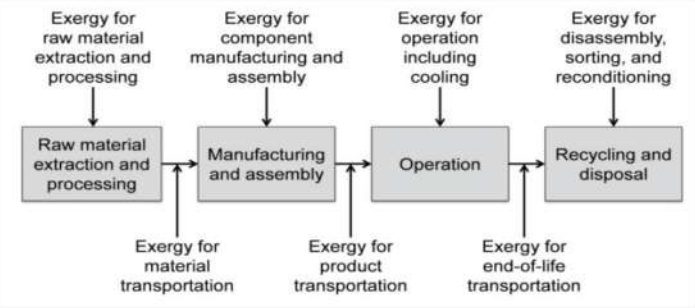

Figure 2. *Energy consumed in different stages of life cycle of an electronic device [6]*

Section V of the research conducted by Bio Intelligence Services presents the information about the embedded energy cost, which is the aggregate amount of energy required for manufacturing, packaging, transportation and end of life, of EPS.[7]. Table1. Presents the measurement of Carbon dioxide produced by manufacturing of power supplies yearly. The petajoules are converted into Megajoules and then multiplied with 1222.25g per MJ to convert it to metric tons. The Table relates the amount of CO_2 in metric tons produced by coal burning power plants to the number of 1000MW(Mega Watt) power plants for manufacturing various devices consumer electronic power adaptors. The energy needed to power the product is the same for both conventional and smart adaptors. And this not included in the embedded energy cost. The embedded energy to supply conventional EPS worldwide is 3.5, 1000MW power plants are required. Smart power adaptors leads to lessen the EPS units as they are interoperable and have the capability to serve multiple devices using the open system model[1].

Product	Petajoules	Metric Tons of CO_2	# 1000MW power plant
Cell Phone	21	2,567,250	0.45
DECT Phone	5	611,250	0.10
Digital Camera	2	244,500	0.04
Set Top Box	5	611,250	0.10
Personal Care	1	122,250	0.02
Standard Battery Charger	3	366,750	0.06
Power Tool Charger	4	489,000	0.08
Printer	4	489,000	0.08
Laptop	2	244,500	0.04
Other	10	1,222,500	0.20
Total Europe		**6,968,250**	1.2
Total Worldwide		**20,904,750**	3.5

Table 1. *CO_2 emission by coal power plants [1]*

However it will always required to manufacture, package and transport some number of EPS, but ultimately we can have a decrement in the embedded energy cost by 85%, As the average of four devices will be powered by the smart adaptors, lessening the demand by 75%, and as they are interoperable it is not required to change them when the new laptops, mobile phones and wireless routers take place of the old ones, which results in significant decrease in Carbon emissions[1]

END OF LIFE

European Community introduced the Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) for controlling the end-of-life (EOL) scenarios of electronic products. And for devices that related to home automation that are not much valued in terms of the material they contained are most probably selected for incineration. There is a little possibility for such a product to be dismantled and to separate the valuable parts like PCB and unsafe parts like LCD screens for recycling or treatment. And the non-recycling parts are sent for landfill disposal. The material used for manufacturing smart power supplies, contained more plastic content so they are much likely to be incinerated. [8]

WORKING OF AN OPEN SYSTEM POWER INTERFACE

The open system interface for developing a smart power adaptor consists of two parts:

1. The load
2. The power hub

The load is basically the electronic product that is powered, and the electronic hub is the multiport AV-DC power adaptor that is charges the electronic products. The load such as a mobile phone or a laptop may execute a digital protocol on its system processor or could install a small, dedicated processor. And the power connector may be a three pin or a two-pin connector. A three-pin connector contains a data pin a ground pin and a power line connection pin. And a two-pin connector the data signal is transferred over the power line. For a three-pin connector, UART physical communication layer governs the transmission between the load and power hub. A two-pin connector has the data signal encoded over the power line and it conveys the transmission by a dedicated load processor.

The power hub has seral components they may have dynamically programable DC-DC convertors, temperature, voltage and current sensors and a dedicated processor that not only executes the open power interface but also controls and gives feedback of the power supplied. The service request could be sent by either the load or the power hub by sending a suitable protocol message [1]. These requested services may include:

(i) Voltage level setting and re-adjustments.

(ii) Requesting statistics like charging level.

(iii) Negotiating a temporary low power state.

CONCLUSION

A lot of EPS gets wasted because they are device-specific power supplies that are only single purpose products, so by using a smart power adaptor we could have interoperable, multipurpose device. And these open system power interfaces could provide a platform for monitoring and controlling a range of next-generation power applications. The life cycle assessment clearly notifies the significant impact of using smart power adaptors in comparison to the conventional ones, as they contribute to less GHG because of lesser plant power to be employed. The open system model is interoperable and could connect multiple devices at one-time so no need for manufacturing product specific power supplies. In future this open system model could be implemented in the charging devices to not only save the energy loss because of device specific power supplies and to control vampire power state but also because it provides a communication between the load and the power hub to control and monitor a range of applications.

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*Figure Source:*https://microgridknowledge.com/

Article 4

Microgrid Testbed Development

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Abstract — In modern world energy demand is increasing day by day. Revolution of smart gadgets, in fact now the world has been shifted to the smart world. In all this revolution role of electrical energy is very prominent. In electrical field not only new methods and techniques are being introduced in transmitting energy but many methods are also established to handle the distribution of energy at grids, like smart grids and microgrids. There are many solid reasons for switching to the microgrid and smart grids. Power losses on long transmission lines, blackouts and bad weather conditions are few of them. The current limitations of infrastructure detain the power grid from meeting the requirement of the restructured power market and the integration of the renewable energy. The Microgrid testbed can utilize the renewable energy sources like wind turbines, solar panels, and PEM fuel cell, it also has the capability of running in parallel with the utility grid. Since the smart micro grid acts as the basic unit of the smart grid, the test bed provides a playground for both research and education purposes. This article presents the idea how effective is to use Microgrid testbed for research.

Keywords — Smart Grid, Microgrid Testbed

INTRODUCTION

The current infrastructure of the power grid determines the unidirectional nature of bulk power transmission from the centralized generation side to the load side. The limitations resulted from the widely used but outdated devices as well as a lack of mature and efficient communication technology detain the power grid from meeting the requirements of the restructured power market and the growing penetration level of the renewable energy. While concerns about environment issues and researches about renewable energy make it possible to generate electricity from brand new approaches like using solar panels and wind turbines, challenges also come along since these intermittent sources are less dispatchable and predictable compared with the large centralized power plants [1]. The complexity facing today requires the power grid to be "smart" in order to provide reliable, clean, and economic efficient energy to the customers, which is referred as "smart grid". The smart grid is defined as "The integration of power, communications, and information technologies for an improved electric power infrastructure serving loads while providing for an ongoing evolution of end-use applications" according to IEEE Standard 2030 [2].

The interoperability of the smart grid not only permits two-way power flow between the utility and the customers by adding distributed generation (DG) and energy storage devices to the user-end, but also enables the customers to play more active roles in

balancing the system generation and consumption through the approaches like demand response and load management [3,4].

MICROGRID AT A GLANCE

As a significant aspect to be considered for power system planning and operation, reliability is challenged more after implementing smart grid. This is because 1) the renewable energy usually has low-capacity factors as well as low correlation with the load profile; 2) the mismatch between the forecast generation and the actual value still needs to be reduced; 3) the transmission and distribution congestion are also critical factors [3]. In order to participate in the power market in a cost-effective way, load management and demand response on the customer side are necessary manners. When a fault occurs, a proper scheme of system protection and control to ensure the safety issues for both customer side and generation side must be proven to be effective at the fust place. Smart micro grid - a smaller scale of smart grid, behaves as the basic unit for future smart grid [5]. Thus, developing new micro grid architectures and control algorithms which has the capability to improve grid performance, reliability, and robustness has significant meaning. The capabilities of the smart Microgrid test bed includes but not limit to the following aspects:

1) Provide power for the household appliances by using renewable sources and energy storage devices; design the control philosophy to guarantee power quality.

2) Improve the reliability of the micro grid by operating in parallel with the utility grid, and disconnect the grid connection when severe faults or disturbances happen; define protection schemes for the micro grid.

3) Simulate the application for the micro grid which can be installed in remote countries and areas where utility grid is not available.

4) Allow the customers to play more active roles in power market by load management and peak shaving; come up with feasible strategy towards an economic direction.

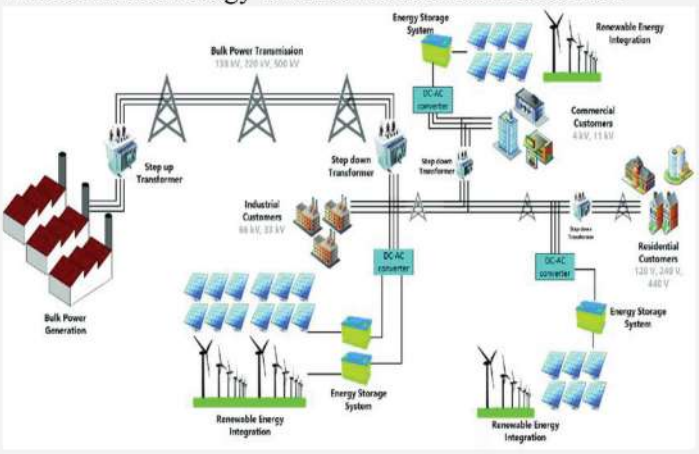

Figure 1. *Microgrid schematic [6]*

ARCHITECTURE OF MICROGRID TESTBED

The smart Microgrid testbed is composed of any number of micro grids, which are connected at a point of common coupling (PCC), as shown in Figure 1. The single-phase utility is also connected at PCC. The structure of the smart Microgrid testbed is intended to increase the flexibility and reliability. By configuring different combinations of the breakers (BR), the test bed can operate in parallel with the utility grid or in islanding mode; the micro grids can work separately to power up different groups of loads and they can also work in master-slave mode which allows them to deliver power to each other when emergency happens.

GENERATION

The electricity power of the smart Microgrid test bed comes from both single-phase utility power and DG in order to provide redundancy when either side fails. DG units are small scale energy sources which are installed near the user-ends. The power sources in the smart Microgrid testbed include different types of renewable generations and a portable diesel generator. Solar panels and wind turbines are installed in micro grid to take advantage of the renewable sources. PEM fuel cell can also be installed to provide an alternative source. The wind power can be captured by small scale vertical axis wind turbines. The wind generator is a synchronous permanent magnet generator which delivers three phase AC output. For the solar power, solar panels are used in series or parallel fashion such that the primal voltage level condition could be met.

CONTROLLER

To integrate the renewable energy sources into the test bed, charge controllers and power electronic converters are necessary. Charge controllers are used to limit the rate of current flow charging the battery to prevent overcharge while keep it fully charged. Equipped with proper charge controllers, the batteries are expected to work safely and have normal life spans. The power generated by the renewable sources are first stored into the 24- volt battery stacks, and then consumed by different load models after going through the inverters. For the wind turbines, the supporting model of Maximum Power Point Tracking (MPPT) wind power charge controllers is used. For the solar panel, the power can be fed into two different types of controllers in different micro grids. Two different controllers can be used for comparison of behavior. The MPPT charge controller can trace the input power and adjust voltage in order to provide the maximum output current to charge the battery. As for the PWM charge controller, the charging current regulated by the PWM algorithm starts to reduce as the battery voltage meets the setting value, then the charging process continues slowly until the battery is fully charged.

ENERGY-STORAGE AND INVERTER

Renewable energy is the most promising alternative when facing the energy crisis and environment issues nowadays; however, its intermittent nature will unavoidably bring some new challenges to the grid. As one of the possible solutions,

the integration of energy storage devices can smooth the variation of the output to certain extent according to the storage capacity even though the load may vary as well. Additionally, the storage devices can benefit the grid by urging the DGs to perform as dispatchable units and they can also provide backup power when emergency happens. Inverter can be single phase if the utility connection at PCC is single phase otherwise three-phase can also be used. Different switching schemes are present for switches. For single phase most common and efficient scheme is sine pulse width modulation but for three phase best possible technique up till now is space vector pulse width modulation.

LOAD FOR MICROGRID TESTBED

One main goal of the smart grid is to provide the customers reliable power with the flexibility of switching between the renewable sources and the utility power. By using the power inverted from the inverters, the smart Microgrid test bed is able to power up some small power rating household appliances like light bulbs, laptops, fans, etc. Power strips are also provided to bring convenience when power access is needed. The loads are divided into different groups and connected to the different micro grids. For research purposes, the programmable ac/dc electronic load can be installed in each micro grid, to simulate different types of power loads.

CONCLUSION

The Microgrid testbed serves both research and education purposes by implementing renewable generation equipment, controller equipment, energy storage equipment, load equipment and data acquisition equipment. On the one hand, the testbed may works in parallel with the utility grid to increase the reliability for the customer and utilize the clean energy sources to reduce the environment impacts; while on the other hand, it may run in the intentional islanding model when utility power is under fault conditions or where the utility power is not even available, thus one possible solution for powering up the remote rural areas is brought up.

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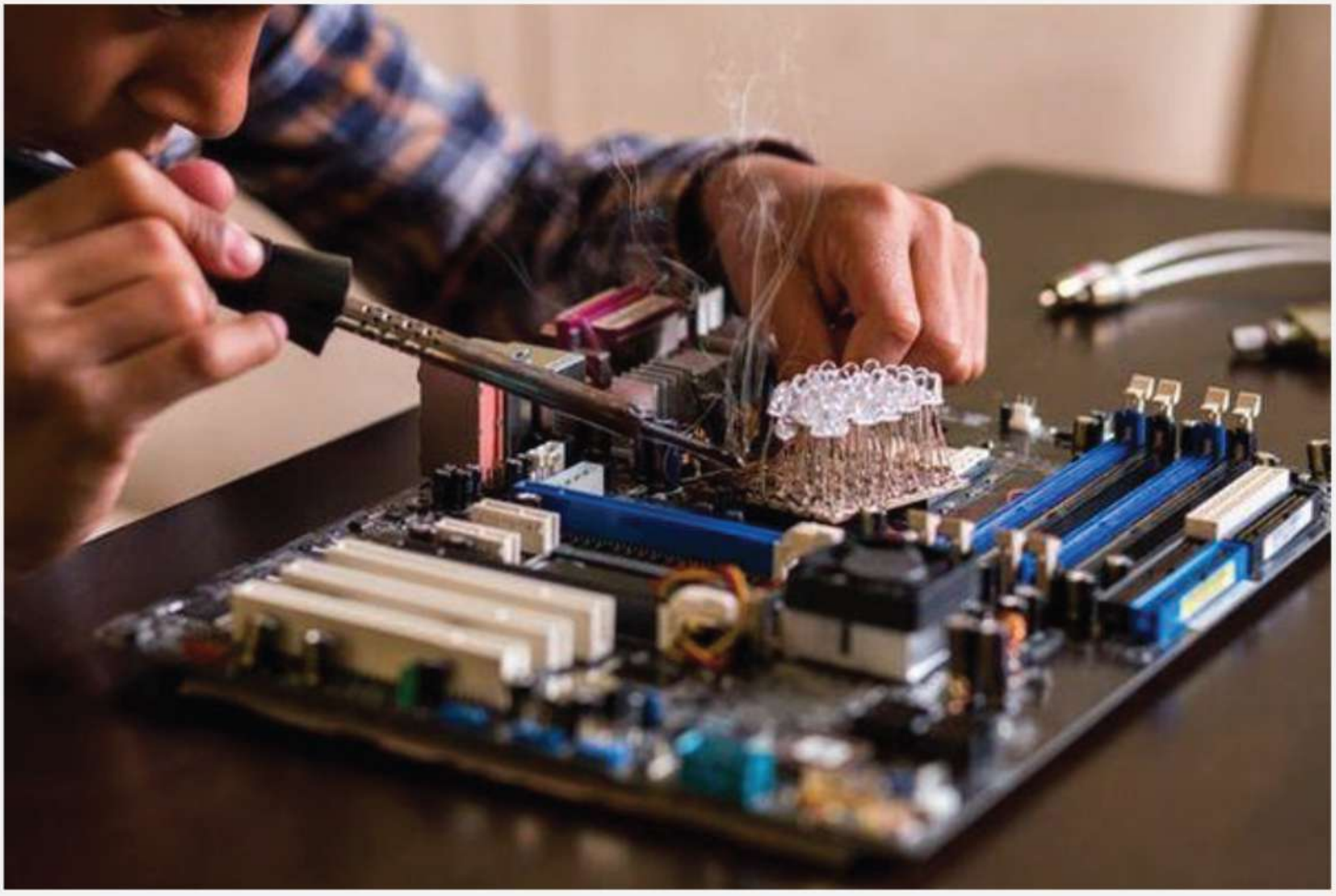

Figure Source: https://www.helptostudy.com/

Article 5

Selecting the Majors in EE Final Year: The Most Common Confusion

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Abstract — With the expansion of electrical engineering into versatile domains, there came unprecedented vagueness in the decision to select the right specialization field. Students are often confused about the scope of the subjects they are supposed to select. Moreover, our education system has absolutely no commendable link with the industry, owing to which students are unable to know the future aspects of the three major fields of electrical engineering. Most of the students, unfortunately, follow suit and thus select the majors that others suggest them. However, this decision greatly impacts your frame of reference to determine the career objective and it is highly recommended to select majors in your final year through careful consideration of your interests and aims.

Keywords — Computer, Electronics, Telecom, Electrical, Power

INTRODUCTION

The process of choosing an elective starts with a natural process of Questioning yourself "What I want to do once I graduate?". Although there is no hard and fast rule implying that you can only proceed with your career based upon the majors you once opted, but it is quite evident that you are unconsciously biased to hunt job in connection to what you studied as your major subjects.

The answer lies in your own interests and nobody should pick academic courses in accordance with ' going with the flow' strategy [1].

To broaden your perspective, this article is a try to enlighten you briefly with key points – about several career options driven by selecting the relevant majors; so that you might envisage your career roadmap before eleventh hour.

COMPUTER SCIENCE SUBJECTS

Right now the most demanding graduates in the job industry are those who are skillful in computer science related subjects (Machine Learning, Artificial intelligence, Computer Networking , Data Base etc) [2]. Jobs in this sector are exponentially growing, therefore if you want to target this specific sector you should select your subjects wisely so that once you graduate – you are already equipped with strong primary base of these subjects and thus you can easily acquire an ideal job.

However, if a student doesn't like to do programming after several attempts or he doesn't dream to sit and work in front of a laptop for whole day in future then It is completely 'OK' to not opt these subjects as your major.

I would emphasize again on the primary message 'PURSUE THE FIELD THAT SEEMS INTERESTING TO YOU'. Moreover, if a student doesn't have any interest and feels equally good at any subject of each field, then my personal suggestion would be to develop skills in CS subjects.

ELECTRONICS AND TELECOM SUBJECTS

For graduates having majors in electronics and telecom, the job sector with electronics related job description majorly includes 'embedded system' jobs and opportunities in 'research sector'. Meanwhile in telecom sector there are a very few onsite jobs for fresh graduates thus most of the students choose research work and then direct themselves for Masters degree from abroad.

ELECTRICAL AND POWER SUBJECTS

The main target for most of the students studying these subjects is applying for govt job specially SDO in NTDC, WAPDA and DISCOs. In my opinion, other than these, the opportunities in industry right now for these students are very limited due to saturation of these graduates in the market and less emerging jobs; therefore, most of the students are compelled to hunt for non-technical jobs like planning, proposals, sales and marketing etc. For your knowledge, I would like to add that most of the managerial roles in leading Multinational Companies are acquired by graduates in this major. Though these non-technical jobs are sometimes even more convenient than technical jobs, but I would sincerely recommend that students should already know their target, rather than being compelled to switch their field later due to unavailability of opportunities.

CONCLUSION

It is always suggested to choose the field that suites your interests, in connection to that, it is necessary to plan your roadmap before choosing the majors. Once you know where you desire to proceed, nothing can stop you from landing your dream job. Best of luck!

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Article 6

Figure Source: https://www.tdworld.com/

Smart Switching and Monitoring of Electric Load

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Abstract — Power quality is a big concern in the electric power sector at present. Switching and nonlinear loads are the major contributors to this issue. To make efficient power usage, we need to observe the electrical parameters making notes. There are many electrical equipment's which are used to measure electrical parameters manually but there is a problem that how we can make an economical and user-friendly mobile application or computer software to measure and make notes of these electrical parameters globally using the internet for industrial and domestic users. In this article, we are going to present the techniques and methodology to serve these purposes.

Keywords — Smart Switching, Smart Monitoring, Motor Control, Cloud Computing and Application development.

INTRODUCTION

Electric power plays a vital role in promoting energy consumption for the betterment of society. Power supply problems are critical because they will directly affect the performance and maintenance of the electric load. By using smart equipment's, we can observe electricity consumption and its quality on a daily, weekly, and monthly basis depending upon our requirement. Having visibility to formulate measures of electrical parameters we can save electricity consumption and expect to reduce the value of public services to achieve economic goals. A simple and cost-effective smart system must be created to monitor electrical parameters including voltage, current, power factor, total harmonic distortion factor and energy consumption. More electrical parameters may also include depending upon requirements.

Reference [1], developed a device that can measure voltage, current, power factor, power, and energy consumption. Reference [2], compared the results of monitored electrical quantities trend at LAB-JTE and ICTUNILA building showing that the conditions of electrical quantities in ICT-UNILA building has a better measurement result. Reference [3], used web technology to monitor electrical quantities in real-time at H Building of Engineering Faculty, University of Lampung (Unila). Reference [4], implemented internet of things technology in real-time monitoring of electrical quantities. Reference [5], implemented raspberry pi based smart supervisor using internet of things. According to reference [6], access to real electrical measured quantities is required for a successful implementation of demand response in the residential sector. Reference [7], proposed a model of energy harvesting and

storage system for the circuits and wireless apparatus including electronic components.

METHODOLOGY

A smart electrical network should be designed to monitor voltage, current, power factor, total harmonic distortion, power and energy consumption. Registered knowledge is stored in the database with the help of a controller, the mobile cloud application manages this knowledge and displays the data report through the online interface. This analysis is performed on the three-phase induction motor present in our laboratory. UET Lahore (Main Campus) Department of Electrical Engineering. Voltage and current values are captured using a step-down transformer and current sensor, they fed the data to analog to digital converter to digitalize it. Switching is done with the help of the triac and triac driver connected to the controller. A zero-detection circuit was made to calculate power, power factor and energy consumption values through scientific calculations done in the coding. Python Programming language was used for the measurement of data processing and we use Raspberry Pi Model B because the controller provides the internet of things.

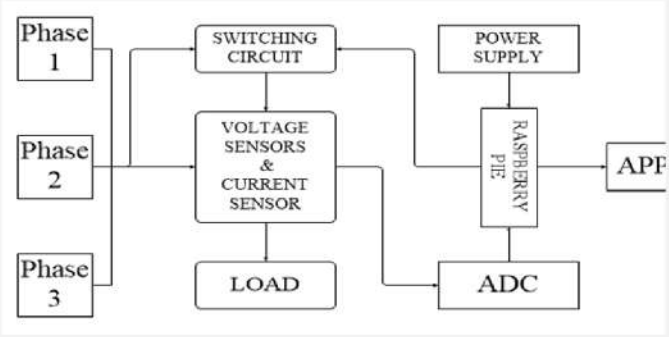

Figure 1. *Block diagram of the proposed design*

The output data is stored in the database, and data reports can be accessed online using the blynk application because it provides free basic level services. Blynk platform allows you to build interfaces for monitoring and controlling hardware projects from your PC and Android device. Blynk app, allows you to create a project dashboard. In which you can arrange buttons, graphs, sliders and other widgets onto the home screen of the application.

Figure 2(a). *Developed hardware*

Figure 2 (b). *Developed hardware*

We are showing our three-phase power, voltage and current values on-screen of the blynk application along with a button that will control the switching of our three-phase load. This app allows you to easily control your hardware wherever you are located in the world. You just have an internet connection and blynk app installed on your android device. Figure 2 showed the developed hardware.

DISCUSSION AND ANALYSIS

- For the system to be used better, this application must be integrated with the notification system. Developing mobile applications for this project is highly recommended. In addition, the project must be expanded to multiple locations to conduct trials in more than two areas. Finally, the results of the data from this study should be used as a reference for future planning, evaluation and improvement of the electrical system.
- The internet of things will allow remote detection or control of any object wherever it exists in network infrastructure, creating opportunities to integrate the real world in a computing environment system. In addition to elimination, also has excellent efficiency, precision and economic benefits. When the internet of things adds advanced sensors and actuators, technology will become a class of examples of cyber-physical systems.
- There are large and complex projects like Smart Grid that are developing solutions to meet these challenges. However, some scenarios may be more practical, so the initial real investigation is done at the simulation level. Therefore, the purpose of this study is to develop a simulation platform between the two parties that allows real-time monitoring and control and simulation tests of the electric power network.

CONCLUSION

The monitoring and controlling of three phases of induction motor in real-time is done and the measured data is shared on cloud server available on android application in smart-phone. The user can monitor and control the induction motor through the android app and can also review the past readings saved in the database.

This prototype work has been done to implement it on the real-world application of a water pumping station at UET Lahore.

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SURAH *“Taha”*
VERSE *“114”*

“

فَتَعٰلَى اللّٰهُ الْمَلِكُ الْحَقُّ ۚ وَلَا تَعْجَلْ بِالْقُرْاٰنِ مِنْ قَبْلِ
اَنْ يُّقْضٰٓى اِلَيْكَ وَحْيُهٗ ۫ وَقُلْ رَّبِّ زِدْنِيْ عِلْمًا ﴿۱۱۴﴾

“Exalted is Allah, the True King! Do not rush to recite ˹a revelation of˺ the Quran ˹O Prophet˺ before it is ˹properly˺ conveyed to you,1 and pray, “My Lord! Increase me in knowledge.”

”

Figure Source: https://www.youtube.com/

Article 7

Selective Harmonics Elimination

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Abstract — Harmonics in a system indicate an aspect of quality of the signal, supply, or system. Not only that they are fatal to magnetic components of electrical devices, but these harmonics are also a source of increment of losses in electrical appliances. Selective harmonic(s) elimination is a process in which selective (mostly lower order) harmonics are eliminated. It has been around for many years and has been used for elimination of pinpoint component of harmonics depending upon the requirement.

Keywords — Harmonics, Selective Harmonics Elimination (SHE)

INTRODUCTION

The following figure depicts the difference between expected outcome waveform and real outcome that includes the impact of harmonic content

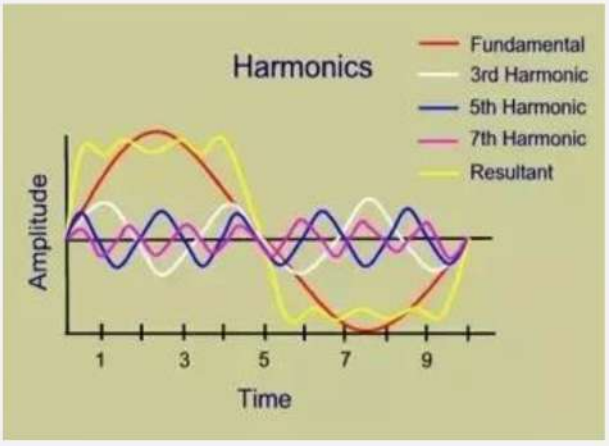

Figure 1. *The Impact of Harmonics, Source: https://www.electricalindia.in/harmonics-in-power-system/*

WHAT IS SHE?

Selective harmonics elimination, as the name depicts, is the process of getting rid of whatever component(s) of harmonics that application requires. The main purpose is to eliminate or at-least minimize the magnitude percentage of the 'most-wanted' harmonics as compared to fundamental below a certain percentage so as to solve the faced problem.

THE NEED FOR SHE

Harmonics affect the working, output and quality of inverter and other electrical devices by introducing noise or distortions along-with the creation of losses. Thus, it is extremely important that these are eliminated in one way or another.

HOW TO DO SHE?

When the Fourier analysis of the output waveform is done, equations related to the fundamental component and harmonics are obtained. The chosen ones among the latter are put equal to zero and the system is then operated on the proposed conditions of the obtained solution. In case of inverters, the switching angles are the outputs of this whole process with inequality ascending order constraints involved. Some of the famous methods deployed for solution of narrated problem are:

- Newton Raphson method
- Comparison of waves to make PWM
- Optimization algorithms

Newton Raphson method but it had high dependence on good initial guess [1]. As the count of local minima increases, it becomes inappropriate to use such techniques [2].

Comparison of triangular and sinusoidal waves has also been done to produce PWM for mitigation [3] but losses, inaccuracy and increased total harmonic distortion was a concern.

The demand of healthy initial guess and reduced efficiency for multi-objective complex problems has reduced the use of basic iterative techniques in the near past. This space was filled by optimization algorithms which are good metaheuristic algorithms involving solution of problems with many minima/maxima in it. In recent years, many optimization techniques have been used for the sake of doing deletion of selective harmonic(s).

Optimization algorithms filled that empty space with the qualities like the absence of derivatives as were present in Newton Raphson method [4]. This actually ensured that the algorithm would search out the answers present at the boundaries too. The other pro is the lack of dependence on the goodness of guess presented in the beginning. In fact, any initial value of the independent variables involved will suffice keeping in mind that the initialization must be within the limits assigned to that particular variable. The initial values are generally assigned on the random basis so this can be said that starting point of the algorithm is different on each of its run [4]. The benefit obtained via randomness involved in the optimization methods under usage is that if a hunter gets to a local peak, it should not get stuck into that. Walking randomly aids in avoiding that scenario where the particle or a hunter is pulled in the depths of local optimal values [4]. This helps in moving towards the best answer globally present for any problem at hand.

The working of these metaheuristic algorithms depends on the problem for which they are intended to be deployed along-with many other factors like the number of hunters or particles used for conquering this task and the number of iterations involved in one run of the concerned algorithm. The constraints also play their part in deciding the complexity of the problem and thus the working efficiency of the algorithm and getting to know how the algorithm takes on the problem with the involvement of constraint(s). There are other control parameters that are linked to each method individually and their type is dependent on the nature of the algorithm.

CONCLUSION

Selective harmonics elimination is the procedure of diminishing the content of the harmonic that hurts the most. As one tries to eliminate more and more harmonic contents, objective becomes more and more difficult and thus requires more sophisticated algorithms which can deal with multiple extremities and constraints that are involved.

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Article 8

Figure Source: https://menafn.com/

Non-Intrusive Load Monitoring (NILM)

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Abstract — The article illustrates a very unique yet powerful method of monitoring the energy consumption of either domestic or industrial loads down to appliance level, called Non-Intrusive Load Monitoring due to its ability to record the electricity usage without intruding the privacy of users' loads by following the three simple steps of data collection, feature extraction and then classification. It is simple to install and does not require an individual sensor for each load, hence making it cost effective and less complex.

Keywords — Data acquisition, machine learning algorithms, load shedding, total harmonic distortion

INTRODUCTION

Due to the enormous increase in electricity usage, it has become a necessity to manage the demand response in accordance with generation. In areas where generation is well below the required threshold, demand side management is achieved by shedding loads at peak hours. One generic and costly solution is to produce more electricity outside the cities, increase transmission routes to transfer the electricity to cities, install more grids and feeders and hire more personnel. This process concatenates construction, equipment, production, transmission, and maintenance costs, alongside the salaries of additional employees. Alternatively, these all measures can be avoided by doing efficacious load management to cope the problem of excessive demand. And doing legitimate metering which means that the right money is received for the customer according to their consumption and to aware the audience about adequate electricity consumption.

Non-intrusive load monitoring (NILM) is a way for homeowners, building managers and electric supply companies to monitor energy consumption on an appliance-by-appliance basis without having to install dedicated

sensors for each appliance and across an entire house or office building. [1]

WHY NILM?

Two of the other load monitoring methods that are in use nowadays are Intrusive Load Monitoring (ILM) and Home Energy Management System (HEMS) [2]. But these methods have some limitations, such as:

- Load monitoring of system is done as whole, not at appliance level
- Sensors are required to be installed with each load
- Not a cost-effective method

On the other hand, NILM requires only a single set of sensors and can monitor loads of each load present within a system.

Growing public interest in smart homes and smart meters has put NILM back into the limelight. Smart meters build on conventional energy meters has been given the ability to communicate with the central office of utility company. At a certain level, this allows utilities to track and manage customer energy consumption for their demand response programs. But it has benefits for the end user as well, offering consumers information on their energy consumption in a way that's easily accessible even to a technical layman. Electricity providing entities around the world are or will be bringing in time-of-day usage tariffs. These tariffs try to discourage power consumption during peak hours of usage and defer that consumption to off-peak hours (also known as peak shaving). Peak Shaving (PS) is a response to the rolling blackouts caused by demand exceeding the supply. In many cases this occurs during days of extreme hot weather when too many air conditioners are operating, cooling homes and businesses.

Better management of load requires better monitoring system. To overcome the problems of load shedding, demand side management and to present an effective and cheaper load monitoring system, it is required to keep track of every single device within a system. This can be achieved using a NILM based meters which are simple to install and do not require an individual sensor for each load.

NILM IN THREE STEPS

NILM method is based on three simple steps of data acquisition, features extraction, and loads classification. [3]

Data Acquisition

The electrical information (such as voltage and current) of individual as well as appliance combinations is collected from the potential transformer and current sensor using a personalized circuitry. [4]

Features Extraction

The data thus acquired is then transferred into the micro-controller for the calculation of unique signatures, such as, power factor, active power, reactive power, harmonics and total harmonic distortion (THD). The selection of the appliance' signatures can differ from user to user depending upon their approach and hence the system efficiency.

Classification

Last component of NILM system is classification. It refers to the method by which features extracted from the acquired aggregated load data are analyzed to identify individual devices by applying sophisticated supervised machine learning algorithms using well defined data to classify the appliances. [5]

CONCLUSION

Day-to-day innovations in the field of electronics have brought radical change in the lifestyle of people as the outdated gadgets around them are becoming more and more advance. Smart homes, equipped with smart appliances and automated control are gaining more popularity nowadays. Hence, it became necessity to equip these smart homes with less complex and cost-effective load monitor system, such as, NILM based energy meters. This technique has an advantage over traditional ILM system due to its less complexity because of presence of only one set of sensor and reduced cost. Despite of being so advantageous and having diverse applications of NILM, efforts are still required to make this technique mature enough to classify more than one number of similar complex electronic appliances present within the same system.

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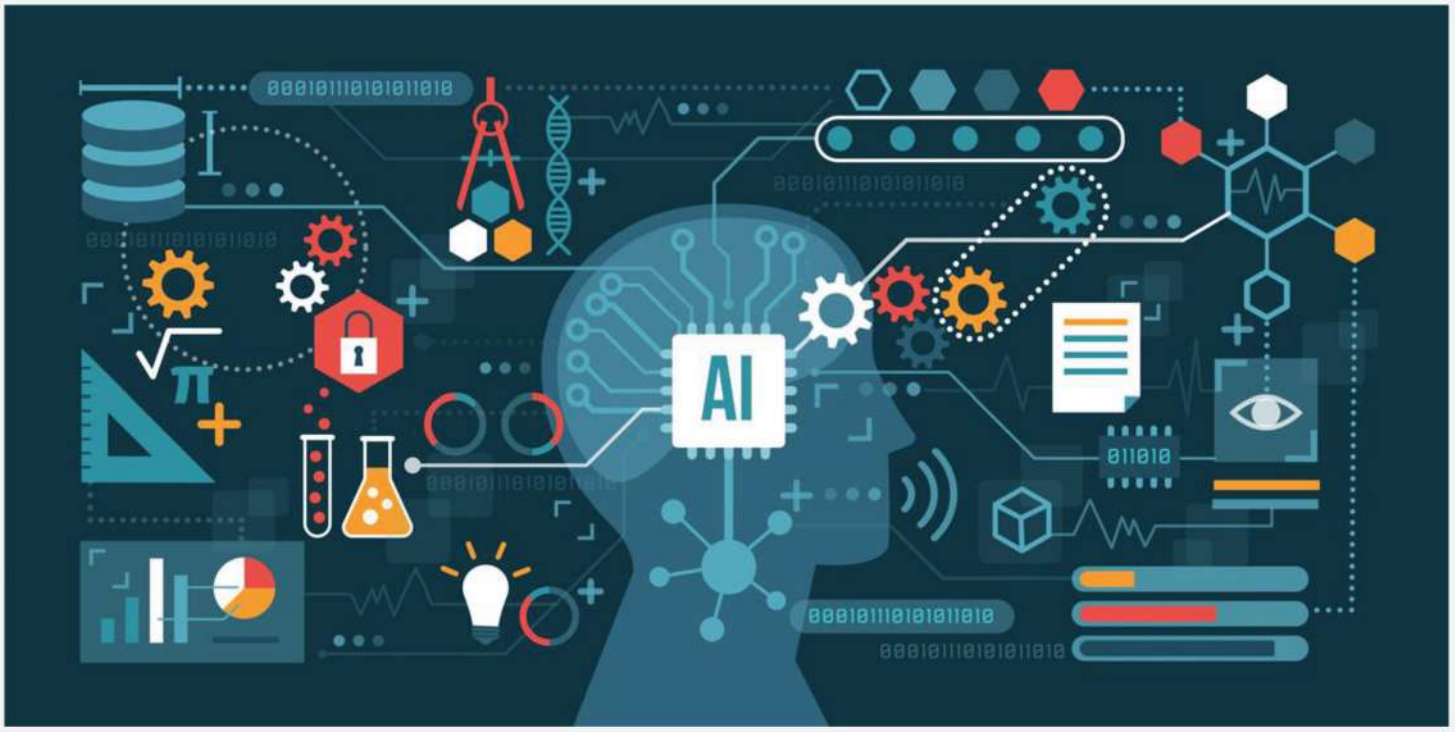

Figure Source: https://bestarion.com/

Article 9

AI COMING OF AGE IS, UM, COMING!

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Abstract — Artificial Intelligence has focused on improving the decision making of machines. The core of technical approach will be a cooperative, game-theoretic extension of inverse reinforcement learning, allowing for the different action spaces of humans and machines and the varying motivations of humans.

Keywords — Biological brains, limited memory, artificial intelligence

Figure 1. *AI has slowly been taking over the world, Source: https://bernardmarr.com/default.asp?contentID=1829*

INTRODUCTION

The ability of biological brains to sense, perceive, analyze, and recognize can only be described as stunning. Further they have ability to learn. Mankind's understanding of how biological brains operate exactly is limited [1]. To avoid these complex workings of biological brains, scientists introduced Artificial Intelligence (AI).AI consists of four main types which includes **reactive machines, limited memory, theory of mind and self-awareness.** The expansive goal of AI is to rise many questions and debates. So that no singular definition of this field is universally accepted.

ADVANTAGES AND DISADVANTAGES

AI reduce a lot of human brains effort. AI reduce error by human brains as the instructions gave to the computer was precisely given and the machine cannot change these instructions by their own so that really reduce human brain error. AI is available at any time any place it's not like humans which needs some rest to do work these are machines that only requires power. Human brains get bored by repeating the same work, but AI can do the same work with the same efficiency. Although with the help of AI computers can do anything but beside this AI also have some limitations that includes Artificial intelligence can never fit in all solutions always it requires a new solution for a new problem and new instructions by humans for the given task. AI always requires humans' supervision to perform task.

HOW TO BUILD AI?

The most important part in building AI is how to define the problem then Analyze the given problem the next most important step is of identification of solutions then choosing the solution and the last step is of implementation. [2] This is done by training your computer on some data so that it can learn from the data and predict or identify as the program follows. The data consist of a large item related to the program. For example, if we want to identify between some pictures then the training data consist of many pictures on which the machine or computer will train. If the problem consists of some audio or video, then the training data will be a large set of audios or videos related to the problem.

APPLICATIONS OF AI

Artificial intelligence is revolutionizing the world by its wonders. [3]

- AI can be used in different games where a lot of thinking and strategy is required in each move like chess and GO.
- AI is used in healthcare to find the cure of different diseases and to predict different diseases from symptoms more efficiently.
- AI is used to predict the stock markets and price of different objects. AI is used to implement different programs that are used by many companies.
- AI is also used in social media to predict the interest of the user and then recommending the posts or videos according to his/her interests.

CONCLUSION

Most probably in the coming ages, AI will play a very dominant role in our society that will reduce human efforts up to a large extent in almost all industries. But it will also make humans lazy, and it will reduce the demand of many jobs as those jobs will be done by machines that are more persistent and restless than human beings in performing complex computational tasks. AI will make most of our things very easy, but it is very hard to say that with the help of AI we can dominant Human brains, as it is human brain that devised artificial intelligence and artificially intelligent machines.

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Article 10

Evolution of Wireless Technology

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Abstract — Wireless technology has advanced to 5G technology. This article will highlight some core advancements in wireless technology. Different features of new generation wireless technology will be elaborated. Also, we will conclude how the public will benefit from this technology evolution to have faster connectivity.

Keywords — fifth generation, IOTs, IPv6, bandwidths

INTRODUCTION

In this fast-paced digital era, seamless connectivity is a must. Different generations of mobile network technologies have evolved with time providing more bandwidth and other features. Currently, fifth generation (5G) is at progress to provide best connectivity for digital devices and IOTs (Internet of things). Other applications such as augmented reality or virtual reality (VR), autonomous driving and wireless backhaul which is a substitute for labor intensive optical fiber installation require more data rates and less latency which will be provided by 5G technology [1].

FEATURES OF WIRELESS TECHNOLOGY

The previous generation wireless systems consume a lot of power. In cellular networks, base stations consume 60% of available power. So 5G architecture is being designed in such a way to consume less power and if load on network decreases, the base stations should cover more regions and unnecessary base stations should shut down automatically [1].

Due to high bandwidths, it will allow mobile cloud computing. The user will be able to use those applications which were not supported by his headset with the help of cloud computing [1].

It allows pervasiveness i.e.; the connectivity will be between 'network of networks'. The user will be given uninterrupted service while roaming and the user can connect with different wireless access technologies. Moreover, it can provide connectivity to different wireless devices simultaneously [1].

It will support IPv6 addresses which are of 128 bits and 4 times more than 32 bits IPv4 addresses. The main objective of 5G will be to replace current core mobile network with a single worldwide network based on IPv6 for control, packet data, video and voice [2].

COMPARISON OF WIRELESS TECHNOLOGIES

Following table summarizes the evolution of different generation wireless technologies and compares their core features [2].

Technology/ Features	3G	4G	5G
Data Bandwidth	2Mbps	2Mbps to 1Gbps	1Gbps & Higher
Standards	WCDMA CDMA-2000	Single unified standard	Single unified standard
Technology	Broad band-width CDMA, IP technology	Unified IP and seamless combination of broadband, LAN/WAN/ PAN and WLAN	Unified IP and seamless combination of broadband, LAN/WAN/PAN/WLAN and wwww
Service	Integrated high quality audio, video and data	Dynamic information access, wear-able devices	Dynamic information access, wear-able devices with AI capabilities
Multiple Access	CDMA	CDMA	CDMA & BDMA
Core Network	PACKET NETWORK	INTERNET	INTERNET
Handoff	Horizontal	Horizontal & Vertical	Horizontal & Vertical

Table 1. *Comparison of 2G, 3G and 5G technologies [1]*

CONCLUSION

To conclude this article, 5G technology will revolutionize the wireless communication technology. Its features will provide high data rate and reliable communication at an affordable rate. Its efficiency will offer less latency and the user can connect to multiple wireless devices at the same time.

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Figure Source: https://lkoundourisaint101.wordpress.com/

Article 11

Gesture Recognition

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Abstract — Signal processing has many applications in several appliances made for daily use. Image processing is one the important areas of signal processing that has been advancing for many years now to do wonders in the domain of signal processing. This article explains that what is gesture recognition feature that is one of the types of image processing, its applications and how it aids in many daily life problems where other methods fail.

Keywords — Image processing, gesture recognition, algorithms

INTRODUCTION

Gesture recognition means to understand the human gestures with the help of mathematical algorithms [1] - [4]. These gestures are mostly recorded from face and hands. Gesture recognition is a technology by which one can interact with and control the machine only by motion of body parts i.e., without touching the machine physically. The way humans understand sign language, in the same way the machine understands the gestures, mostly by recording them through a camera vision. It is seen as a richer bridge to connect human wit machine rather than conventional text input and GUI methods. Gesture recognition is time saving and offers high stability and accuracy.

It finds its application in numerous areas; like automotive sector, electronics sector, home automation, security, smart phones and gaming etc. the most commonly used computer language for building up such algorithms is Python and JavaScript.

Figure 1. *A gesture recognition algorithm detecting hand's location, Source: https://en.wikipedia.org/wiki/Gesture_recognition*

APPLICATION OF INTEREST (TRANSPORTATION ROBOTS)

Now a day's transportation is becoming more and more comfortable. Still disabled people find it difficult to use various commands like turning the A.C. on, moving the seat back and for the, using the music systems etc. Furthermore, mouse, keyboard or touch system undergo wear and tear due to long term usage. In case of voice recognition feature,

silence is required so that the device can understand the demand properly, but there develop some situations where it becomes quite difficult to maintain silence, like in a traffic jam, near factories, near crowded places etc. [1]. Also, in the field of robotics some people find it cumbersome to understand that how to communicate with the machine through complex inputs. Therefore, an alternative is required to deal these situations. Hence, an alternative is required [2].

GESTURE RECOGNITION AS A SOLUTION

Here the gesture recognition plays its role and provides easiness to the user. In case of travel, the vehicle is installed with a gesture recognition device, that adjusts the position of seat, music volume and other various functions through the motion of passenger's hands and head. In case of accidents, sudden movements trigger the device to open the airbags. One can adjust the air conditioner and mirrors via hand movements. This resolves the utter silence requirement for the voice recognition. Also, there are no moving parts and physical contact, so wear and tear are not an issue. By just camera's aid demand of user can be fulfilled, and cameras are made to withstand the minor stress they face [3].

Figure 2. *An automobile gesture recognition feature, Source: https://www.futureelectronics.com/resources/ftm/intelligent-sensing-and-signal-chain/vishay-automotive-gesture-recognition-systems*

In case of robots, no technical knowledge and sophisticated input devices are required. Through motion of hands one can easily command a robot to pick up a thing, bring it to some location or to do some other stuff like moping the floor, cleaning the furniture etc. Therefore, it becomes very handy for disabled and elderly people to make the machine understand their command through gesture recognition [4].

CHALLENGES ASSOCIATED WITH GESTURE RECOGNITION

There are many challenges associated with the accuracy and usefulness of gesture recognition software. For image-based gesture recognition there are limitations on the equipment used and image noise. Images or video may not be under consistent lighting, or in the same location. Items in the background or distinct features of the users may make recognition more difficult.

The variety of implementations for image-based gesture recognition may also cause issue for viability of the technology to general usage. For example, an algorithm calibrated for one camera may not work for a different camera. The amount of background noise also causes tracking and recognition difficulties, especially when occlusions (partial and full) occur. Furthermore, the distance from the camera, and the camera's resolution and quality, also cause variations in recognition accuracy.

CONCLUSION

Gesture recognition feature can aid in many situations where the conventional and other modern and sophisticated systems fail in serving the disabled humans, specially, in transportation robotics.

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Article 12

Electrical Hazards and Safety Measures

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Abstract — Electricity, now the most indispensable part of our lives also comes with great risks which can put lives and properties in danger to a great extent. This necessity of identifying and eliminating the potential hazards and accidents could be fulfilled by Electrical Safety Audits.

Keywords — Electricity, Hazards, safety measures, fire, electric shock

INTRODUCTION

An electrical hazard is a dangerous condition wherever an employee will make electrical contact with energized instrumentation or a conductor. The main hazards of operating with electricity are:

- Electric shock and burns from contact with live parts.
- Injury from exposure to arcing,
- Fire from faulty electrical equipment or installations.

Electrical hazards are in different forms; however, all have the potential to cause serious injury.

According to the Electrical Safety Authority (ESA) there were 83 electrocutions in Ontario from 2001 through 2010. According to ESA, the most common cause of occupational electrocution is using an improper procedure (60%).[1]

RANGE OF FATAL VOLTAGES

The human body has an inherent high resistance to electric current, which means without sufficient voltage a dangerous amount of current cannot flow through the body and cause injury or death. As a rough rule of thumb, more than 50 volts is sufficient to drive a potentially lethal current through the body. Any electrical device used on a house wiring circuit can, beneath bound conditions, transmit a fatal current.[2]

SEVERITY OF ELECTRIC SHOCK

Electric shock is another hazard common to several items of laboratory equipment. Any electrically power-driven item of laboratory equipment that is subject to spillage of chemicals or water, or exhibit signs of excessive wear ought to be used carefully.

Electrical shocks occur once the circuit completed by a part of human body, this will occur by contacting a silver part of a chunk of apparatus that has become energized by contact

with an electrical conductor. The severity of the shock depends on the following:

- The amount of current passing through the body
- The duration of the current flow
- The current path through the body.
- Whether the skin is wet or dry? [3]

EXAMPLES OF ELECTRICAL HAZARDS

Common types of electrical hazard include:

- Contact with live wires leading to electric shock and burns.
- Fires due to faulty wiring.
- Exposed electrical parts.
- Ignition of fires or explosions due to contact with doubtless inflammable or explosive materials.
- Improper wiring
- Improper grounding, generally caused by staff deliberately removing the bottom pin on an electrical plug to suit a two-prong extension cord
- Interaction with overhead power lines
- Damaged wire insulation, inflicting electrical conductors to create contact with every other, tools, or a worker's body
- Overloaded circuits
- Wet conditions.[4]

DEATH RATE DUE TO ELECTRIC SHOCK

In the United States, there are approximately 1000 deaths per year, as a result of electrical injuries. Of these, approximately 400 are due to high-voltage electrical injuries, and lightning causes 50 to 300. There are also at least 30,000 shock incidents per year which are non-fatal.

SYMBOLS FOR ELECTRICAL HAZARDS

The common image for electricity could be a lightning bolt.

Voltage or Shock Hazard Symbol

This symbol will be known by employing a bolt or a bolt through a hand, that lets folks know that injury or death will occur from close high-voltage electrical equipment.

Static Hazards

If you see a lightning bolt on all-time low of a shoe, then you recognize that there's a danger of an explosion occurring from static electricity.

Buried Cable Symbol

A bolt with an arrow pointed downward is employed to spot buried cable signs.

Danger/Safety (Universal)

A triangle with an inside punctuation is that the universal image for danger associate degreed generally safety as well.

Restricted Areas Prohibition signs

They are utilized in areas to stop folks from walking into a danger zone. These signs are sometimes found in high-voltage areas akin to substations or areas wherever high-voltage electricity is used.

Electrical Devices

Appliances, switches, wire boxes and different electrical devices are often marked with an electrical safety sign that warns users of what dangers may occur throughout use.

Health & Safety

Health and safety signs mark wet floors, fireplace exits, and electrical safety conditions, among others. On electrical safety signs that address health and safety, the danger can typically be delineated mistreatment one word written across the sign.[5]

Figure 1. *Comprehensive image depicting Electrical Safety Signs and Symbols*

PREVENTION FROM ELECTRICAL HAZARDS

There are numerous ways of protecting folks from the hazards caused by electricity, using

- insulation,
- guarding,
- grounding,
- electrical protecting devices. [6]

SAFETY RULES FOR LABORATORIES

Laboratory users will considerably scale back electrical hazards by following some basic precautions:

- Inspect wiring of apparatus before every use. Replace broken or worn electrical cords immediately.
- Use safe work practices when electrical equipment is used.

- Know the placement and the way to control shut-off switches and/or fuse panels. Use these devices to shut off equipment within the event of a hearth or electrocution.
- Limit the utilization of extension cords. Use just for temporary operations then only for short periods of time. In all alternative cases, request installation of a brand-new electrical outlet.
- Multi-plug adapters should have circuit breakers or fuses.
- Place exposed electrical conductors (such as those typically used with action devices) behind shields.
- Minimize the potential for water or chemical spills on or close to electrical equipment.[6]

CONCLUSION

Training staff to figure safely around electrical hazards may be a vital demand for maintaining worker safety. Electricity is a heavy geographic point hazard which will end in serious injuries and even fatalities if your staff aren't properly trained.

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Figure Source: https://www.blendspace.com/

Article 13

Distance Learning: Engineering Education & COVID 19

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Abstract — This document analyzes the impact of remote classrooms and labs as a result of "social exclusion" during the COVID-19 outbreak. It is important to analyze the emergence of web technologies and tools available in online learning and your impact on engineering education. The focus is on finding a way out to deal with related issues continuing teaching and learning during a long study break due to this unexpected epidemic. Other challenges in the developing economy include the unavailability of internet services across the country and limited resources available to the general public for self-discovery and learning during the epidemic. This study sets out various policy guidelines for the online delivery of engineering courses and testing techniques as they have experience during this global epidemic. These recommendations will give a roadmap for quality teaching and quality online engineering courses.

Keywords — Engineering Education, COVID 19, Virtual Labs

INTRODUCTION

With the outbreak of the COVID-19 epidemic, academics are striving to continue their efforts to promote quality education to avoid the loss of academic semester. The World Health Organization (WHO) has announced that the permanent closure is the only possible way to reduce the spread of the disease so far that has led to more than 3,57,688 causes worldwide and the number is growing daily [1]. South Asia becomes the next epicenter of this epidemic. Pakistan statistics for COVID 19 are shown in Figure 1 [2]. In Pakistan, the Higher Education Commission (HEC) issued guidelines during universities to prevent the spread of COVID-19 disease followed by the immediate closure of all schools, colleges and institutions of higher learning (HEIs) due to lockout. In that case, institutions of higher learning (HEI) will be left with no choice but to study distance learning (DL) mode to complete the semester. Departments of higher education are also directed to all universities to ensure strict monitoring and reporting mechanisms to ensure quality standards in online teaching.

Figure 1: *COVID 19 No of cases in Pakistan (until May 18, 2021) [2]*

Engineering education is a challenging field that requires adequate integration of classroom instruction with harmonized board instructions. Today, the world is considered a global village due to innovation and advancement in information technology (IT) infrastructure. Therefore, it is possible to design online tutorials where a

student in the remotest part of the world can access the world's leading scholars [3]. In addition, international collaborations between universities (which provide similar engineering programs) can be established to achieve long-term laboratory use where a lab in a technologically advanced country can be used by a student living in a developing country. Fold in such situations, in a sense that they are required to provide infrastructure, training and policy guidelines to all faculty members regarding the conduct of online activities during the COVID-19 emergency. On the other hand, universities should also aim to maintain consistency and quality standards and thus bring quality to DL's learning activities.

ONLINE LEARNING ENGINEERING

Engineering education has some unique features compared to non-engineering domains. Students need to develop a structured approach by learning theory and concepts in the classroom following practical tests in the psychology laboratory in order to solve real-world problems.

I. Remote classroom: Online classes are held in real classrooms with students and teachers not in the visual range. Such arrangements rely solely on information technology (IT) infrastructure and digital computer platforms [4].

II. Virtual Labs: Engineering labs are an integral part of commands that require hands-on application of basic concepts learned in the classroom. 13 Such lab facilities are technically advanced over the internet to provide all the basic tools for students to run labs. such models exist, for example, the design and use of a visual communication control lab for students studying electrical engineering and computer science. Such platforms are available on the online automotive testing bench to demonstrate basic concepts in mechatronics engineering's.

THE ROLE OF TEACHERS IN E-LEARNING

In any education system, be it online or traditional, teaching skills play a vital role in ensuring that high standards of education are provided to students. However, in online education, the role of faculty members is critical to ensuring that at least a minimum of quality is maintained in online teaching [5]. learning pedagogy.

I. Quality Standards in DL: It is important that teaching staff involved in online teaching follow the principles of an online education program. These practices include developing effective course strategies, sharing weekly programs with students, signing up for weekly activities, keeping a record of student participation, doing practical assessment tasks, conducting course assessment rubrics and above all process tests using occasional student distractions. improving the quality of online teaching [6].

II. Skills Development: It is important to emphasize that faculty members should participate in skills building programs related to the basic use of online teaching tools, online design strategies, and online teaching skills. 22 keeping a log of weekly activities is important to maintain quality. To this end, teachers should continue to regularly update data on the number of live sessions performed, tests conducted during week, a list of integrated topics, online tutorials and any other E-learning tool used.

III. Student Involvement: A teacher using e-learning mode must find ways to engage students effectively. Since, students have been there, distant participation in the visual classroom, maintaining their interest and enthusiasm for learning is very important [7]. To this end, students should be given the opportunity to share their concerns by building chat rooms and discussion forms. In addition, they should be encouraged to identify challenges and they need to be given adequate guidance so that they can meet these challenges. Students should also have a place to connect with their own collections to create the feeling of a real learning environment. In addition to standard courses, instructors should direct students to other online resources available on course-related web; this can create a sense of student self-esteem.

BENEFITS OF ONLINE LEARNING

There are certain benefits of online learning, which surpass the traditional teaching mode. Online teaching can be synchronized or compatible. Comparisons of both teaching models are shown in Figure 2.

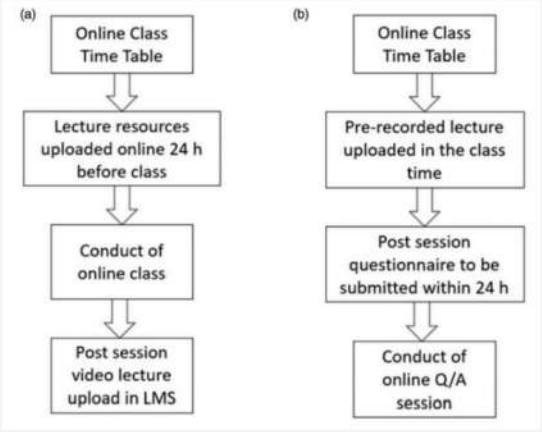

Figure 2. *Internet Teaching in Engineering. (a) Compatible Teaching Model (b) Compatible Teaching Model [8]*

I. Availability and Comfort: Online teaching mode enables students to take lectures as they wish as available online 24/7. This gives them extra comfort to attend classes from their local area.

II. Spatial Flexibility: With online / DL teaching mode, student presence does not have to be geographically bound and may be present if appropriate communication technology is available to facilitate online courses.

III. Impact on learning outcomes: Online learning has been tested to assess its short-term and long-term outcomes. It is evident that the online learning process of students does not have a significant effect on the short-term learning outcomes. Instead, it greatly affects the long-term learning outcomes.

IV. Cost Effective: Online learning mode is also expensive. The University saves money in terms of terms electricity bills due to low energy consumption and the need for HVAC. Small travel means less pollution, healthier in nature, social and economic. In addition, in the event of online (paperless) tests, significant savings on static items can be guaranteed. Because of these facts, in addition to developing countries, most low-budget universities around the world have opted for free online study tools.

CONCLUSION

This document highlights the practices of online learning and teaching in the various engineering programs offered by Pakistani universities during the COVID-19 epidemic.

It is interesting to note that this problem has led to the discovery of new dimensions in online teaching of engineering courses and has enabled various grade learning tools to use for teaching and assessment. DL mode is used to help understand and apply the basic concepts of online engineering methods. It is emphasized that the OCDM online assessment of competency is important for maintaining quality by ensuring online courses at various levels and incorporating student feedback as a key performance indicator. In addition, policy guidelines are specially tested for conducting online theory / lab testing and FYP testing.

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ALUMINI ACHIEVEMENT

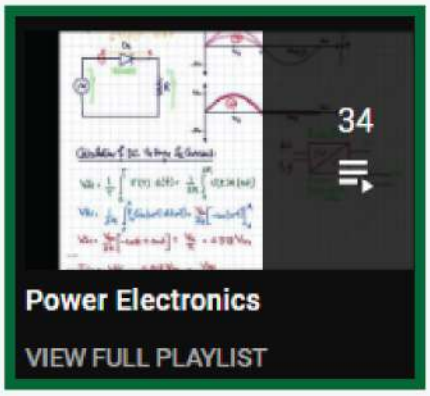
SYED ABDUL RAHMAN KASHIF

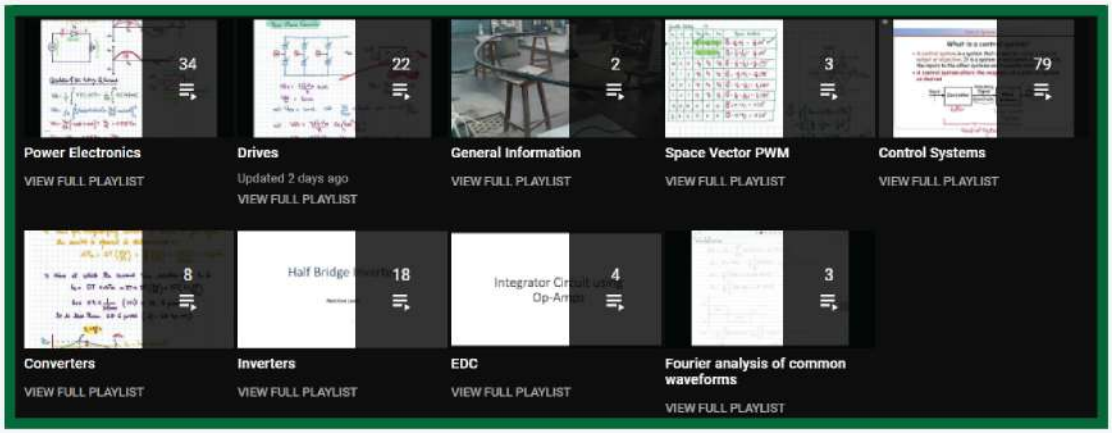
Dr. Syed Abdul Rahman Kashif is an Associate Professor in the renowned Department of Electrical Engineering at the University of Engineering and Technology, Lahore. He completed his Ph.D. in 2014 from the same prestigious university of Pakistan.

As an avid researcher, he worked as a Research Associate in University of Paderborn, Germany in 2009-2010. His extensive research areas include power electronics, electrical machine drives, inverters control for high power applications, optimization techniques for power system planning, energy policies, and high voltage system. He is also diligently working as the Final Year Project Coordinator and Deputy Director of High Voltage Engineering Lab since 2012.

During the COVID pandemic, he established a YouTube channel to coach students of Electrical Engineering. He has mentored two comprehensive courses, Control Systems and Power Electronics, on his YouTube channel.

SOME TUTORIALS:





Suscribe his channel

https://www.youtube.com/c/SyedAbdulRahmanKashif/playlists

ALUMINI ACHIEVEMENT

FATIMA ABBAS

EE BATCH 2016

As an organized and creative individual, she believes in evolving herself to a better version each day. Being an electrical engineer, coding comes as a major interest. Nevertheless, she has never hesitated to opt for courses out of her field, and one of the best skills she learned on her journey is "Graphics Designing".

It not only helps in technical fields by enabling individuals to draw complex diagrams but also refines the visualization of thoughts. Its scope is not only limited to basic learning skill as one can also choose it as a side profession and can earn a handsome amount by freelancing.

She has conducted many workshops to transfer this skill to juniors and when she saw their overwhelming response and enthusiasm, she stared a YouTube channel "XeroToOne" which is currently tutoring many people to get expertise in this skill.

xero 2ne

LET'S LEARN TOGETHER!

@XeroToOne

According to her, learning Adobe Illustrator is more valuable than many Microsoft Office applications. This is because it introduces you to a whole new world of endless opportunities. Usually, students mistake the word graphic designing with just art & design. However, in reality, it gives students a big edge in their technical fields as well. It not only helps one in crucial tasks like report writing, FYP posters but it also aids in regular tasks like presenting a complex process with a very simple layout for better understanding of viewers.

SOME TUTORIALS:

If you also want to learn Graphics Designing, then you are most welcome to subscribe to her channel "XeroToOne".

https://www.youtube.com/channel/UCDNfw69t275TzNsCGT7vepw

@XeroToOne

SURAH *“Fatir”*
VERSE *“28”*

“

وَمِنَ النَّاسِ وَالدَّوَآبِّ وَالْاَنْعَامِ مُخْتَلِفٌ اَلْوَانُهٗ كَذٰلِكَ ؕ اِنَّمَا
يَخْشَى اللّٰهَ مِنْ عِبَادِهِ الْعُلَمٰٓؤُا ؕ اِنَّ اللّٰهَ عَزِيْزٌ غَفُوْرٌ ﴿۲۸﴾

“And of mankind and beasts and cattle (ÉAncam includes cattle, camels, sheep and goats) in like (manner) (are) different colors. Surely only the ones of His bondmen who are apprehensive of Allah are the knowledgeable. (i.e. learned ones) Surely Allah is Ever-Mighty, Ever-Forgiving.”

”

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