



# CEIT, POSTER BOOKLET

RCC- 1<sup>ST</sup> RESEARCH SYMPOSIUM - POSTER (RESPONSES)

# CEIT

# RCC-1st Research Symposium - Poster (Responses)

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	PB-2	Amr Yousef	Shoreline Extraction from LiDAR DEM Data and Aerial Images					
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## **ULTRA-SENSITIVE OPTICAL SENSOR USING PLASMONIC N**ANOPARTICLS

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#### **ABSTRACT**

AN ULTRA-SENSITIVE OPTICAL NANO-SENSOR USING PLASMONIC NANO-PARTICLES OF DIFFERENT METALLIC MATERIALS SUCH AS GOLD, SILVER, COPPER AND VANADIUM DIOXIDE IS INTRODUCED IN THIS PAPER. THE SURFACE PLASMON RESONANCE OF PLASMONIC MATERIAL IS DEPENDING ON THE REFRACTIVE INDEX OF SURROUNDING MEDIUM SUCH AS GENERIC ORGANIC POLYMER WHERE THE REFRACTIVE INDEX IS CHANGING ACCORDING TO GAS CONCENTRATION IN CONTACT WITH ITS SURFACE. REFRACTIVE INDEX SENSITIVITY AND HALF WIDTH FULL MAXIMUM OF THE OPTICAL INCIDENT WAVE FOR DIFFERENT METALLIC NANOPARTICLES IS SIMULATED USING FDTD METHOD. HWFM AND REFRACTIVE INDEX SENSITIVITY ARE COMPARED FOR DIFFERENT REFRACTIVE INDEXES OF SINGLE AND TWO DIFFERENT SIZES OF DIFFERENT METALS PLASMONIC NANOPARTICLES. MAXIMUM REFRACTIVE INDEX SENSITIVITY, 580 NM/RIU, IS OBTAINED USING TWO DIFFERENT SIZE GOLD NANOPARTICLES BY USING THE PROPOSED STRUCTURE.

#### TRANSMISSION SPECTRUM OF **NANOPARTICLES ARRAY**

- THE BASIC IDEA OF SENSORS USED ANALYTE MATERIAL IS THAT, THE REFRACTIVE INDEX OF ANALYTE MATERIALS IS CHANGING ACCORDING TO GAS CONCENTRATION IN CONTACT WITH ANALYTE MATERIALS. CONSEQUENTLY, WE CAN SENSE OPTICAL WAVE BY DIRECT/INDIRECT MONITORING THE REFRACTIVE INDEX CHANGE OF THE USED POLYMERIC MATERIAL WITH THE CHANGE OF GAS CONCENTRATION [1-2].
- WE CAN HYPOTHESIZE THAT ANY SLIGHT CHANGE OF THE REFRACTIVE INDEX OF THE USED ANALYT MATERIAL DUE TO THE PRESENCE OF SMALL CONCENTRATION OF THE SENSED GAS WILL BE INDIRECTLY DETECTED BY OBSERVING THE SHIFT OF THE SPR WAVELENGTH OF THE USED NANOPARTICLES.
- PLASMONIC PARTICLE'S SHAPE, DIELECTRIC FUNCTION OF THE GOLD NANOPARTICLES, AND DIELECTRIC CONSTANT OF THE SURROUNDED MEDIUM ARE DETERMINE THE SPECTRUM POSITION AT MAXIMUM VALUE OF THE TRANSITION. THE MAXIMUM VALUE OF REFLECTIVITY IS LOCATED AT WAVELENGTH MAX ACCORDING TO THE CONDITION [3]:

$$\lambda_{max} = \frac{L}{q} \left( \frac{\varepsilon_d \varepsilon_m(\lambda_{max})}{\varepsilon_d + \varepsilon_m(\lambda_{max})} \right)^{1/2}$$

 A METALLIC NANOPARTICLES DIELECTRIC PERMITTIVITY CAN BE DESCRIBED BY USING A MULTI-OSCILLATOR DRUDE-LORENTZ MODEL [4]:

$$\varepsilon_m = \varepsilon_{\infty} - \frac{\omega_D^2}{\omega^2 + j\omega\gamma_D} - \sum_{k=1}^6 \frac{\delta_k \omega_k^2}{\omega^2 - \omega_k^2 + 2j\omega\gamma_k}$$

ullet Where  $arepsilon_{\infty}$  is the dielectric constant at high FREQUENCY REGIME IN THE DRUDE MODEL,  $\omega_D$  and  $\gamma_D$ ARE THE PLASMA AND COLLISION FREQUENCIES OF THE FREE ELECTRON GAS ACCORDING TO DRUDE MODEL,  $\delta_k$  IS DEFINE AMPLITUDE OF LORENTZ OSCILLATOR,  $\omega_k$  IS THE RESONANCE ANGULAR FREQUENCIES.

#### THE PROPOSED STRUCTURE

IN THIS WORK, THE PROPOSED OPTICAL SENSOR USING PLASMONIC METALLIC NANOPARTICLES AND ANALYT MATERIAL IS STUDIED. I AM USING OPTIFDTD SIMULATION TOOL BY OPTIWAVE INC. THE FDTD METHOD WAS PERFORMED USING THE OPTIFDTD SIMULATION TOOL. IN OUR DESIGN, CARTESIAN COORDINATES X, AND Y ARE SATISFY PERIODICITY IN BOUNDARY CONDITIONS, WHILE, ANISOTROPIC PERFECT MATCHING LAYER WAS USED IN THE Z-DIRECTION TO SERVE AS ABSORBING BOUNDARY CONDITION.

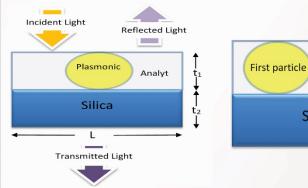
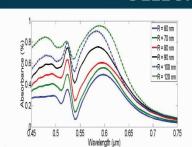


FIGURE 1 CELL STRUCTURE OF THE OPTICAL SENSOR USING PLASMONIC NANOPARTICLES FIGURE 2 CELL STRUCTURE OF THE TWO DIFFERENT SIZES PLASMONIC NANOPARTICLES

#### **SELECTIVE RESULTS**



Material	SPR n=1.1	SPR n=1.3	S <sub>n</sub> (nm/RI U)	HWFM
Αυ	593.66	650.28	283.10	77.86
Ag	576.92	630.25	266.64	36.90
VO <sub>2</sub>	549.78	564.97	75.92	11.01
Cu	585.17	640.11	274.69	54.13

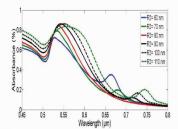
Silica

Second

particle

FIGURE 3. ABSORBANCE OF GOLD NANOPARTICLE OF DIFFERENT RADII FOR N=1.1 VERSUS THE

 TABLE 1
 WAVELENGTH SENSITIVITY AND HWFM FOR FOUR DIFFERENT NANOPARTICLES



Radius of the sec. (nm)	Sn for G1 (nm/RIU)	Sn for G2 (nm/RIU)
60	163.09	428.53
70	128.50	479.97
80	110.87	-
90	132.02	535.41
100	115.48	556.04
110	58.122	544.28

FIGURE 4. ABSORBANCE OF TWO GOLD NANOPARTICLES 80 NM AND FROM 60 NM TO 110 NM RADIUS FOR N=1.1 VERSUS WAVELENGTH.

TABLE 2. SN OF TWO GOLD NANOPARTICLES WITH RADIUS 80 NM AND FROM 60 TO 110 NM FOR

#### CONCLUSION

GOLD NANOPARTICLES GIVES THE HIGHEST SENSITIVITY AND VANADIUM DIOXIDE HAS THE LOWEST SENSITIVITY OF 359.3 AND 150.13 NM/RIU RESPECTIVELY, IN CASE OF USING SINGLE PLASMONIC NANOPARTICLE. FWHM OF AU NANOPARTICLE IS 77.86 NM AT SPR 593.66 NM AND VO2 HAS 110.01 NM AT 549.78 NM FOR ANALYTE REFRACTIVE INDEX 1.1. DUE TO THE SECOND RESONANCE WAVELENGTH GROUP WITH HIGH

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# SHORELINE EXTRACTION FROM LIDAR DEM DATA AND

#### **AERIAL IMAGES**

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#### **INTRODUCTION**

- > Shoreline is a spatial varying separation between water and land.
- Several data sources such as: historical land-based photographs, coastal maps and charts, aerial images, beach surveys, multispectral/hyperspectral images, LiDAR DEM data and microwave sensors can be used to extract the shoreline locations.
- In this work [1], we develop two novel algorithms that can effectively extract shorelines depending on the available data sources.
- > The first algorithm is a multi-step morphological technique that can work on LiDAR DEM with respect to a tidal datum while the second depends on the availability of training data to extract shorelines from LiDAR DEM fused on aerial images.
- We perform Monte Carlo simulations to estimate the confidence interval for the error in shoreline position. Compared with other relevant techniques in literature, the proposed methods offer better accuracy in shoreline extraction.

#### MORPHOLOGICAL SHORELINE DETECTION

- > It can be used to extract shorelines from LiDAR DEM data with respect to a tidal datum.
- > Based on a given tidal value, it segments the DEM into a binary image where zero pixels correspond to water and one pixels correspond to land.
- Since, some parts of the DEM data may have significant errors in the measurements and can be misclassified as shorelines, the proposed approach reduces outliers and noises by detecting the anomaly based on neighborhood connections. → Fig. 2 and Fig. 3
- ➤ Then, constrained morphological open and close operations are employed to process broken branches and land regions. → Fig. 4
- > In addition, it eliminates man-made structures such as bridges, piers, etc. from the extracted
- shoreline by means of Hough transform which is used to extract a set of structure candidates.
- > The set of structure candidates are then filtered out using a sliding neighborhood scan to identify the correct man-made structures that are eliminated from the final shoreline. → Fig. 5

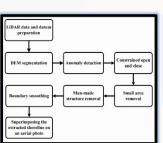


Fig 1. Pipeline of the proposed shoreline detection process.

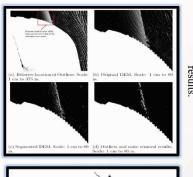


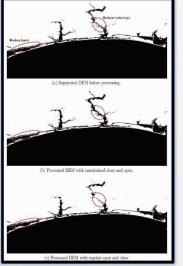
Fig 2. Decision criteria for land and water outliers



Fig 5. Using Hough transform to eliminate a bridge from the extracted shoreline.

Scale:1 cm to 300 m.





# SHORELINE EXTRACTION BASED ON MULTI-MODAL DATA

- We propose an efficient and accurate method to extract the shoreline from the fusion of different remotely sensed data sources including: LiDAR data, aerial images and multi-spectral images.
- > Both the aerial images and the corresponding DEM data should be referenced to a common grid and have the same spatial resolution.
- > The proposed approach converts the aerial images from red-green-blue (RGB) representation into hue-saturation-value (HSV) color space.
- > It classifies the fused aerial images on the DEM data by means of support vector machine classifier.
- > Once the SVM classifier has been trained, it should be applied to the whole data to classify it into water and land regions. Then a small area removal is done to eliminate the unwanted areas from the classified image. Finally, The boundary between water and land is extracted.

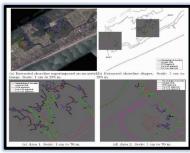
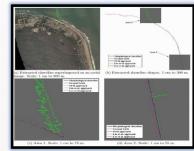


Fig 6. Comparison between the different approaches: Liu et al. [2], Lee et al. [3], Morphological shoreline, SVM shoreline.



**Fig 7.** Comparison between the different approaches: Liu et al. [2], Lee et al. [3], Morphological shoreline, SVM shoreline.

# EXTRACTED SHORELINES ERROR ASSESSMENTS

- > The average of errors are 3.12 m, 2.81 m 4.33 m and 4.92 m for the morphological, SVM, Liu et al. and Lee et al. approaches respectively. → Fig. 8
- Using Monte Carlo simulations the 95% confidence interval of the shoreline position error is [-2.39, 2.31] m in case of SVM approach and [-3.73, 6.14] m in case of the morphological method. → Fig. 9

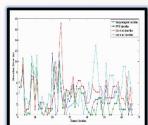
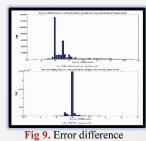


Fig 8. Absolute error differences



distributions

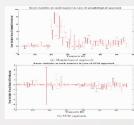


Fig 10. Error difference statistics

#### CONCLUSIONS

- In terms of accuracy, we show that our proposed methods are more accurate than comparable shoreline extraction techniques reported in literature.
- If LiDAR data and its corresponding aerial image are available at the same spatial resolution then SVM is more preferable than the morphological approach. If the only data available are the LiDAR and the tidal datum, then the morphological approach should be used.

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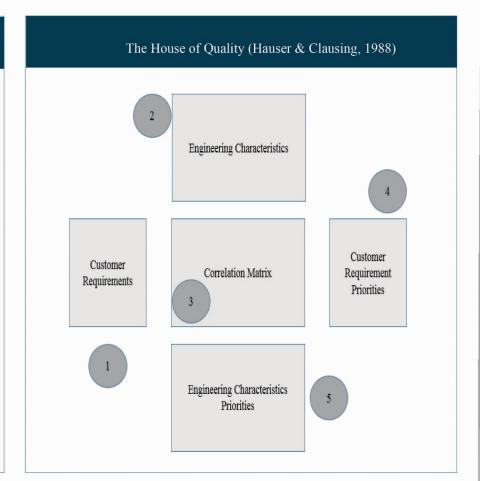
# ECONOMIC ADVANTAGES OF UTILIZING THE INTEGRATED QUALITY SOFTWARE DEVELOPMENT MODEL

#### Mohammad A. Kanan<sup>1</sup>, Gamal Weheba<sup>2</sup>, Ramiz Assaf<sup>3</sup>

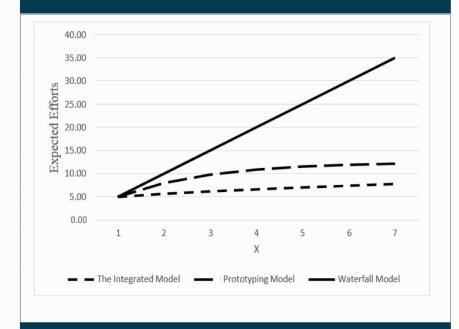
(1,3) DEPARTMENT OF INDUSTRIAL ENGINEERING, COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY (CEIT), UNIVERSITY OF BUSINESS AND TECHNOLOGY (UBT), JEDDAH, KSA <sup>2</sup>DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING WICHITA STATE UNIVERSITY, WICHITA, KS, UNITED STATES



#### The Integrated Quality Software Development Model (IQSD) (Kanan, Weheba, & Jaradat, 2014) Prototyping Customer Requirement Evaluation Sample Application Review & Customer Updating satisfied? Yes Lesson learned Deployment Maintain Test



#### Comparison of PM effort based on development model used.



Future Work

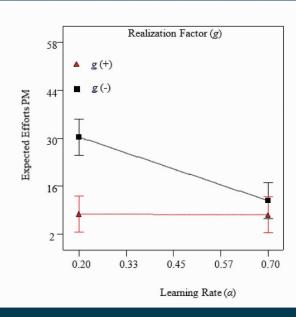
#### • Preventive Value of Integrated Model

- Koshinen (2003) stated that software maintenance costs account for up to 90% of the life cycle cost.
- New function that separates the cost of development from that of maintenance.

#### Models for Estimating Realization Factor

- Minimizing errors of estimating the realization factor.
- Using artificial intelligence and knowledge-based systems to
- Generate patterns of customer requirements.

#### Interaction plot of learning rate $\alpha$ and realization factor g.



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- Hauser, J. R., & Clausing, D. (1988). The house of quality. *Harvard Business Review*, 66(3), 63–73.
- Kanan, M., Weheba, G., & Jaradat, B. (2014). Development of the audit-calc software: A case study. *The Journal of Management & Engineering Integration*, 7(1), 1–8.















# Moisture Diffusion and Permeability Characteristics of Hydroxypropylmethylcellulose and Hard Gelatin Capsules Ahmad S. Barham<sup>a\*</sup>, Frederic Tewes<sup>bc</sup>, and Anne Marie Healy<sup>b</sup>

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#### Introduction

Dry Powder Inhaler (DPI) products typically consist of a device containing a blend of micron-sized drug particles and larger inert carrier particles, which is usually lactose (1). Capsules are frequently used with DPI devices to store the powder blend. Spray dried lactose is very hygroscopic and has a tendency to gain or lose moisture with ease. Since amorphous lactose can crystallise spontaneously above a 50% RH at room temperature, there must be questions concerning the physicochemical composition of DPI-lactose, both when supplied, during formulation and product life cycle.

#### **OBJECTIVE**

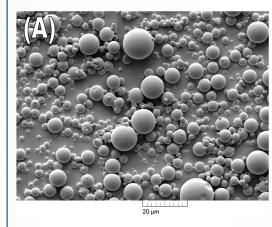
In this study, moisture sorption and permeability characteristics of hard gelatin (HG) and HPMC capsules were studied using dynamic vapour sorption (DVS) techniques and the effectiveness of the capsules in protecting amorphous lactose, i.e. from crystallisation, assessed.

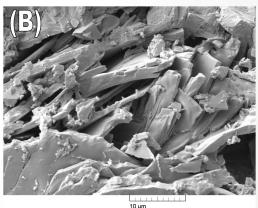
#### **Materials and Methods**

- Gelatin and HPMC (Capsugel®) capsules.
- Büchi B-290 Mini Spray dryer.
- Dynamic vapour sorption (DVS 1, SMS, U.K.).
- Differential scanning calorimetry (DSC) (Perkin-Elmer Pyris Diamond).
- Scanning Electron Microscopy (SEM) (Tescan Mira XMU U.S.A.), operated at 5.0 kV.

#### **RESULTS**

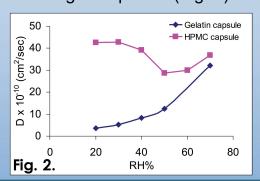
SEM micrographs showed that spray dried lactose consisted of spherical particles with smooth surfaces. Recrystallisation of lactose from the amorphous state led to the formation of plate-shaped crystals (Fig. 1A and Fig. 1B).





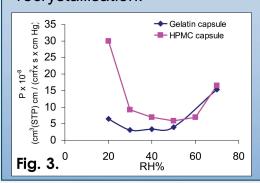
**Fig. 1**: SEM micrographs of **(A)** spray dried lactose, **(B)** recrystallised lactose from the amorphous state upon exposure to humid air at 70%RH, with a magnification of 5K.

Moisture diffusion coefficients across the HPMC and HG capsules wall layer calculated as described by Mwesigwa et al. (2). This change with an increase in %RH could be attributed to the polymer conformation due to the swelling of capsules (Fig. 2).



Moisture permeability values across capsules vs %RH are shown in Fig. 3.

Permeability values across HPMC were higher than those from HG at all the %RH values. This presented that lactose will undergo recrystallisation.



#### CONCLUSIONS

In this study moisture diffusion and permeability values were determined for HPMC and HG capsules that are widely used in the pharmaceutical industry. Neither capsule type adequately protected the contained hygroscopic amorphous lactose from crystallisation or deterioration which was induced by moisture ingress, possibly impairing the formulation stability. Overall, HPMC capsules would be more appropriate to use than HG for a formulation that was not quite as moisture sensitive.

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#### **REFERENCES**

1. French D, Edwards D, Niven R. J. Aerosol Sci. 1996; 27(5): 769-783. 2. Mwesigwa E, Basit A W, Buckton G. J. Pharm. Sci. 2008; 97(10):4433-4445.













#### Electropolymerization of 4-hydroxybenzyl alcohol at various pH values

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#### Introduction

The electrochemistry of the related compound 4-hydroxybenzyl alcohol (4HBA) has not been studied in aqueous solutions. The behaviour of 4HBA in basic methanol solutions has been studied by Pham et al.,¹ and they demonstrated that the electrochemical oxidation of 4HBA leads to the deposition of polymers films on the electrode surface. The observed behaviour is often quite complex and demonstrates a dependence on various factors such as pH.

#### **RESULTS**

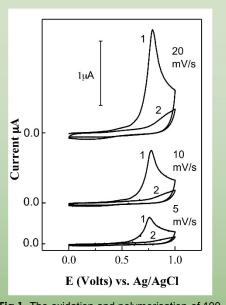
The energies of the HOMOs of the uncharged molecules (predominant at neutral pH), shown in table 1, are very similar. When comparing both molecules it is clear that the formation of the stable benzoquinone molecule, upon the oxidation of 1,4-dihydroxybenzene, provides more insight into the difference in observed behaviour.

		E_HOMO / eV	HOMO Plots	E_LUMO / eV	LUMO Plots
	ОН	-8.5	****	3.4	
	OH	-8.0		3.4	
		3.6		12.5	
	НО	-2.1	ş	7.0	

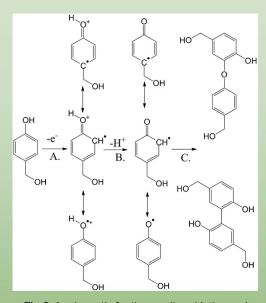
#### **OBJECTIVE**

- Electropolymerisation of 4HBA in aqueous solutions has been studied at different pH values.
- The electrochemical behaviour of 4HBA is compared to that of 1,4-dihydroxybenzene.
- A link is made between oxidation potentials, pKa and the energy of the highest occupied molecular orbital (HOMO) of the molecules in different states of ionisation.

The potentials for the oxidation and polymerisation of 4HBA in sulphuric acid are shifted anodically (Fig.1). A great number of chemical and electrochemical reactions occur when phenols are electrochemically oxidised complicating the analysis of the data. It is expected that 4HBA will follow similar reaction pathways to phenol and the reactions are outlined in Fig. 2.



**Fig 1.** The oxidation and polymerisation of 100 mM 4HBA in acidic solutions. The first two CVs for each sweep rate are shown.



**Fig 2.** A schematic for the anodic oxidation and polymerisation of 4HBA.

#### **Materials and Methods**

- All chemicals were analytical grade and used without further purification.
- •1,4-dihydroxybenzene (99%), 4HBA (98%) were all procured from Alfa Aesar.
- All experiments were carried out in a three-electrode glass cell. An EZstat Pro potentiostat (NuVant Systems Inc., IN, USA) equipped with an EZware 2013.

#### Conclusions

The electrochemical oxidation behaviour of 1,4-dihydroxybenzene and 4HBA is very different. In neutral, acidic and basic solutions the anodic oxidation of 4HBA results in the formation of insulating polymers at the electrode surface.



Reference: 1. M.-C. Pham, J.-E. Dubois and P.-C. Lacaze, J. Electroanal. Chem. Interfacial Electrochem., 99, 331 (1979).













#### INTELLIGENT BASED CONTROL METHOD FOR A TWO-MASS **ROTARY POSITIONING SYSTEMS**

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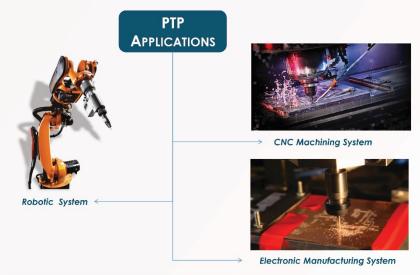
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#### **I**NTRODUCTION

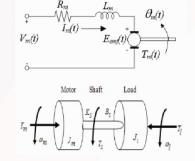
Precision positioning of multi mass systems are widely used in industrial applications, such as advanced manufacturing systems, CNC machining, and robotic systems.

BASICALLY, A POINT-TO-POINT (PTP) CONTROL SYSTEM IS A POSITIONING SYSTEM THAT IS USED TO TARGET AN OBJECT TO A PREDEFINED LOCATION THAT IS REQUIRED TO HAVE A FAST RESPONSE SPEED, HIGH DEGREE OF POSITION, AND HIGH POSITIONING ACCURACY.



A NOMINAL CHARACTERISTIC TRAJECTORY FOLLOWING (NCTF) CONTROL DESIGN APPROACH IS STRAIGHTFORWARD, ADJUSTABLE, AND EASY TO IMPLEMENT; AND A MATHEMATICAL MODEL OF THE SYSTEM AND ITS PARAMETER IDENTIFICATION ARE NOT REQUIRED, BECAUSE THESE CONTROLLERS DEPEND ONLY ON A SIMPLE OPEN-LOOP RESPONSE OF THE SYSTEM.

#### SYSTEM MODEL



Parameter	Value	Unit
Motor inertia, J <sub>m</sub>	17.16e-6	Kgm <sup>2</sup>
Inertia load, Ji	24.17e-6	Kgm <sup>2</sup>
Stiffness, K <sub>c</sub>	0.039	Nm/rad
Motor resistance, R	5.5	Ω
Motor inductance, L	0.85e-3	H
Torque constant of the motor, $K_t$	0.041	Nm/A
Motor voltage constant, Kb	0.041	Vs/rad
Frictional torque, τ <sub>l</sub>	0.0027	Nm
Motor viscous friction, B.,.	8.35e-6	Nms/rad

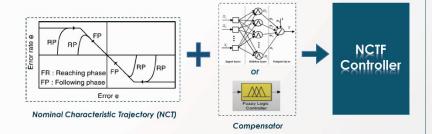
Schematic diagram of two-mass rotary positioning systems

#### Nominal Object Parameters

i arameter	varue	Ollit
Motor inertia, J <sub>m</sub>	17.16e-6	Kgm <sup>2</sup>
Inertia load, Ji	24.17e-6	Kgm <sup>2</sup>
Stiffness, K <sub>c</sub>	0.039	Nm/rad
Motor resistance, R	5.5	Ω
Motor inductance, L	0.85e-3	H
Torque constant of the motor, $K_t$	0.041	Nm/A
Motor voltage constant, K <sub>b</sub>	0.041	Vs/rad
Frictional torque, $\tau_t$	0.0027	Nm
Motor viscous friction, $B_m$	8.35e-6	Nms/rad
Load viscous friction, B <sub>l</sub>	8.35e-6	Nms/rad

#### CONTROLLER DESIGN

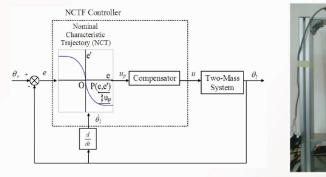
The NCTF controller consists of two elements namely a nominal characteristic trajectory (NCT) and a compensator. The objective of the NCTF controller is to make the object motion follow the NCT and end at the origin of the phase plane (e, e')



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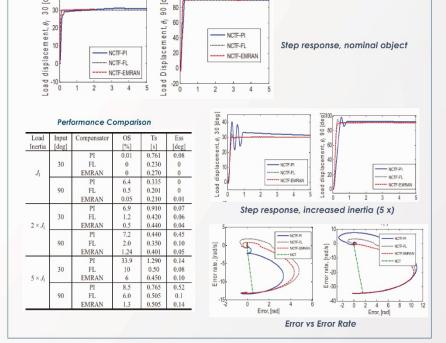
#### **RESULT & DISCUSSION**

#### 1. BLOCK DIAGRAM OF NCTF



Test Bench of Two Mass System

#### 2. CONTROLLER PERFORMANCE



#### **CONCLUSION AND FUTURE PERSPECTIVES**

THIS RESEARCH DISCUSSES AND DESCRIBES A PRACTICAL CONTROL METHOD FOR MOTION SYSTEM APPLICATION WITH PARTICULAR FOCUS ON TWO-MASS ROTARY POSITIONING SYSTEMS. THE PROPOSED CONTROLLERS WERE COMPARED AND EVALUATED THROUGH SIMULATION FOR THEIR POSITIONING PERFORMANCE WITH LOAD VARIATIONS; THEN THE EFFECTIVENESS AND ROBUSTNESS OF THE CONTROLLERS WERE EVALUATED. THE COMPARISON OF THE PERFORMANCE OF THE PROPOSED CONTROLLERS FOR TWO-MASS SYSTEMS BASED ON EXPERIMENTS WILL BE FUTURE WORK.

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# ECG SIGNAL TRANSMISSIONS PERFORMANCE OVER WEARABLE WIRELESS SENSOR NETWORKS

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#### **ABSTRACT**

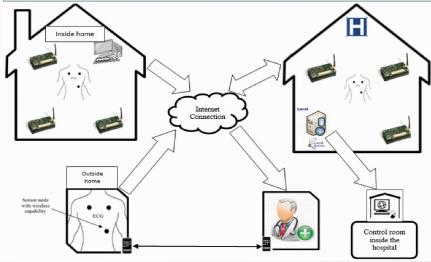
SUDDEN DEATH IS THE MOST COMMON DISEASE OF HEART DISEASES AND USUALLY CAUSED BY CARDIAC ARREST. THE ELECTROCARDIOGRAPH (ECG) SYSTEM IS THE MOST DIRECT WAY TO OBSERVE AND MONITOR HEALTH STATUS OF THE HEART. IN THIS KIND OF DISEASE, THE PATIENT MAY NEED CONTINUOUS MONITORING, AND SOMETIMES IS KEPT IN INTENSIVE CARE UNIT (ICU), WHICH NEEDS MORE UTILITIES AND MANPOWER THAT WILL EVENTUALLY LEADS TO INCREASE THE COST AND DEMANDS FOR QUALIFIED MEDICAL STAFF. IN THIS PAPER WE INTRODUCE A COMPREHENSIVE REAL TIME MONITORING ECG SYSTEM FOR CONTINUOUS MONITORING PATIENTS INSIDE/OUTSIDE HOME. WEARABLE WIRELESS SENSOR NETWORK WITH A CLUSTER HEAD IS CONNECTED TO PATIENT BODY FOR MONITORING. MEASURED DATA BY WWSS ARE TRANSMITTED VIA CLUSTER HEAD TO AN INTERNET CONNECTION TO THE MONITORING SYSTEM LOCATED ON THE HOSPITAL. IN CASE OF EMERGENCY, THE MEASURED DATA IS SENT TO THE PHYSICIAN'S CELL PHONE FOR ANY NECESSARY ACTIONS. WE DISCUSS THE INSIDE/OUTSIDE SYSTEM STRUCTURE. ADDITIONALLY, WE ANALYZE THE PROPOSED SYSTEM IN TERMS OF POWER CONSUMPTIONS AND OPTIMUM DISTANCE BETWEEN WSN SENSORS

#### INTRODUCTION

CARDIOVASCULAR DISEASE IS NUMBER ONE KILLER IN SAUDI ARABIA, ACCORDING TO THE WORLD HEALTH ORGANIZATION (WHO) RECORD. HEART Disease Deaths are almost 24% of the total Deaths in Saudi Arabia in LAST FEW YEARS. IN THE PAST YEARS, WIRELESS SENSORS HAVE RECEIVED INCREASED ATTENTION DUE TO THEIR COST EFFECTIVENESS, CHEAPNESS AND SMALL SIZE WHEN THEY ARE UTILIZED IN DIFFERENT ENVIRONMENTS [1-3]. A WIRELESS SENSOR NETWORK (WSN) IS USED TO MONITOR PHYSICAL OR ENVIRONMENTAL PHENOMENA SUCH AS TEMPERATURE, SOUND, PRESSURE OR MOTION AND TO PASS THE DATA THROUGH THE NETWORK OF SENSORS TO A MAIN LOCATION [4]. ALSO, THEY ARE USED IN MANY APPLICATIONS INCLUDING MILITARY, HEALTH AND HOME APPLICATIONS. THE ECG SIGNAL IS A MEASURE OF THE ELECTRICAL ACTIVITY OF SPECIALIZED HEART CELLS, WHICH GENERATE REPETITIVE SELF-INDUCED ACTION POTENTIALS. EACH ACTION POTENTIAL GENERATED WILL LEAD TO CONTRACTION OF THE HEART MUSCLE AND HEARTBEAT. DURING EACH CARDIAC CYCLE, THE ATRIA AND VENTRICLES CONTRACT AND RELAX TO RESPECTIVELY PUMP AND RECEIVE BLOOD. THE ACCURACY OF THE SIGNAL DEPENDS ON THE RESOLUTION OF THE A/D CONVERTER USED IN THE SYSTEM. MOST OF THE LITERATURE REFLECTS THE USAGE OF 10 BIT OR 12 BIT ADC [5], WHICH IN TURN AFFECTS THE ACCURACY.

#### THE PROPOSED STRUCTURE

THE PROPOSED SYSTEM IN THIS PAPER IS USING WWSS WHICH IS ATTACHED TO THE PATIENT BODY WITH A CLUSTER HEAD SENSOR THAT COMMUNICATE WITH THE DEPLOYED WSNS ON HOME OR HOSPITAL. ALL RECORDED DATA USING WWSS ARE TRANSMITTED VIA WSN TO THE MONITORING SYSTEM LOCATED ON THE HOSPITAL VIA INTERNET. IN CASE OF EMERGENCY, THE HOSPITAL SENDS THE DATA TO PHYSICIAN'S CELL PHONE FOR CONSULTATION. THE PHYSICIAN CAN CONTACT THE PATIENT DIRECTLY FOR ANY INSTRUCTIONS AND THE PATIENT CAN ALSO CONTACT THE PHYSICIAN FOR CONSULTATION. A DETAILED ARCHITECTURE OF THE PROPOSED REAL-TIME MONITORING ECG SYSTEM IS ILLUSTRATED IN FIGURE 1.



#### FIGURE 1 PROPOSED SYSTEM ARCHITECTURE

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#### SELECTIVE RESULTS

WE STUDY THE EFFECT OF TRANSMITTED POWER ON THE ENERGY CONSUMED PER BIT AT THE TRANSMITTER SIDE, THE TOTAL ENERGY RECEIVER AT THE RECEIVER SIDE, RECEIVED POWER AND SNR. THE EFFECT OF DISTANCE ON THE POWER AND ENERGY PERFORMANCE OF TRANSMITTING DATA FROM ECG SYSTEM IS ALSO INTRODUCED IN THIS SECTION. ALL CALCULATED DATA ARE GIVEN AT BOTH OFDM AND MQAM MODULATION TECHNIQUE.

#### 1. Effect of transmitted signal power

THE TRANSMITTED POWER RANGE IS TAKEN FROM 50 MW TO 10 MW AT DISTANCE 1, 3, 5 M BETWEEN SENSORS. THE BITRATE OF THE TRANSMITTED DATA IS 10 KBPS. FIG 2 SHOWS THE EFFECT OF CHANGING TRANSMISSION SIGNAL POWER, FROM 50 MW TO 10 MW ON THE TOTAL POWER CONSUMPTION.

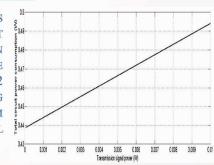
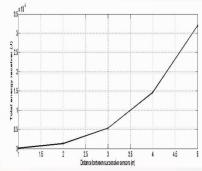


FIGURE 2. TOTAL POWER CONSUMPTION VERSUS TRANSMISSION POWER

#### 2. EFFECT OF CHANGING TRANSMISSION BITRATE

Total energy consumption as a function of distance between successive sensors at 20 kbps and 100 kbps bitrate are illustrated in Fig 3 and 4 consequently. Increasing the bitrate will decries the total energy consumption and will increase the life time of the used sensors.



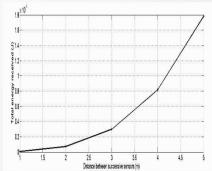


Figure 3. Total energy consumption (J) a function of distance between successive sensors (m) at  $20~{\rm kbps}$ .

Figure 4. Total energy consumption (J) a function of distance between successive sensors (m) at 100 kbps.

Total received energy at 5 m distance and for 20 kpbs and 100 kbps are  $3.5\times10^{-6}$  J and  $1.8\times10^{-4}$  J respectively which means that increasing bit rate from 20 to 100 kbps is saving energy by  $1.7\times10^{-4}$  J. According to our calculations, the maximum number of sensors needed to be installed in the patient's home is 5 sensors.

#### Conclusion

In the proposed system, we introduced a wearable real time monitoring ECG system for observing patients. We discussed the inside/outside system structure and study the effect of power and energy consumptions and optimum distance between WSN sensors on the designed system. We conclude that, by increasing the bit rate from 20 to 100 kbps an amount of  $1.7\times10^{-4}$  J will be saved and the installing 5 sensors in the patient's home is the optimum case that gives an optimum system performance. In order to verify our proposed system we are going to apply the designed system on many cases and different hospitals. Also we are going to extend our system to be a fully monitoring system and 24/7 system.

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# TECHNO-ECONOMIC STUDY ON PV/BB/UG HYBRID SYSTEM

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#### **A**BSTRACT

HYBRID PV/BATTERY BANK/ UTILITY GRID SYSTEM (PV/BB/UG) IS CONSIDERED AS A BASIC SOLUTION FOR ANY SHORTAGE OF FUEL RESOURCES ON A WORLDWIDE. THIS PAPER INTRODUCES A COMPLETE STUDY OF THE PERFORMANCE OF A HYBRID PV/BB/UG SYSTEM. THE COST OF KILO WATT OF EACH INDIVIDUAL SOURCE HAS BEEN CALCULATED AND THE KWH COST OF THE OVERALL PV/BB/UG IS CALCULATED AS WELL TAKING INTO CONSIDERATION THE INSTALLATION AND RUNNING COST. THE INTRODUCED SYSTEM IS SIMULATING THE REAL LOAD OF A BUILDING IN UNIVERSITY OF BUSINESS AND TECHNOLOGY LOCATED IN DAHBAN-JEDDAH, SAUDI ARABIA. THE OPTIMAL POWER MANAGEMENT IS CARRYING OUT USING THE DESIGNED PROGRAM WHICH HAS BEEN TRAINED AND TESTED USING ACTUAL DATA AND UNDER DIFFERENT OPERATION CONDITIONS. MATLAB-SIMULINK IS USED FOR CARRYING OUT A SIMULATION USING DAILY DATA OF THE LOAD DEMAND. INSOLATION AND TEMPERATURE OF JEDDAH SITE, KSA.

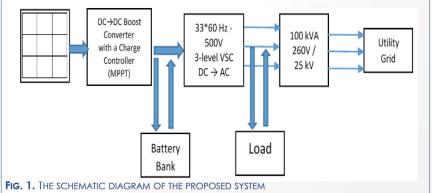
#### INTRODUCTION

RENEWABLE ENERGY IS CONSIDERED AS FUTURE SOURCE OF ENERGY AS CLEAN AND CHEAP SOURCE ENERGY [1]. SOLAR ENERGY SOURCE BEING A CLEAN, UNFAILING AND ENVIRONMENT-FRIENDLY POTENTIAL RESOURCE AMONG ALL RENEWABLE ENERGY OPTIONS. BUT IN THE PRESENT STORY, THERE IS A NEED OF CONTINUOUS SUPPLY OF ENERGY, WHICH CANNOT BE SATISFIED DUE TO SEASONAL AND PERIODIC VARIATIONS BY ALONE SOLAR PHOTOVOLTAIC SYSTEM [2-3].

THEREFORE, IN ORDER TO FULFILL THE LOAD DEMAND THE SUGGESTED CONNECT THE SOLAR TO THE GRID AND CONVENTIONAL CONVERSION UNITS ARE NOW BEING IMPLEMENTED AS A GRID CONNECTED ENERGY HYBRID SYSTEM WHEN USING CHARGING SYSTEM TO USE IT WHEN SOLAR RADIATION IS DECREASING [4].

# SYSTEM COMPONENTS CHARACTERISTICS AND MODELING

FIGURE 1 SHOWS THE MAIN COMPONENTS OF THE PROPOSED SYSTEM. AS ILLUSTRATED IN FIGURE 1, THE PV/BB/UG HYBRID SYSTEM CONSISTS OF PV ARRAY, AND BATTERY BANK CONNECTED TO THE UTILITY GRID. THE OUTPUT POWER FROM PV ARRAY IS PASSING THROUGH DC TO DC BOOST CONVERTER WITH CHARGE CONTROLLER (MPPT). THE OUTPUT POWER IS THEN CONVERTED TO 3-PHASE USING DC TO AC CONVERTER BEFORE CONNECTED TO THE LOAD OR TO THE GRID.





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#### **SELECTIVE RESULTS**

WE DESIGNED A HYBRID PV AND BATTERIES BANK CONNECTED TO THE UTILITY GRID USING SIMULINK TOOLBOX IN MATLAB AS SHOWN IN FIGURE 2. FIGURE 2 SHOWS THE 100-KV PV/BATTERY GRID CONNECTED SYSTEM. THE SYSTEM IS CONSISTING OF PV SOLAR PANEL WITH DC-DC BOOST CONVERTER WITH CHARGE CONTROLLER (MPPT), DC-AC CONVERTER, AND BATTERY BANKS.

#### A) SYSTEM CONFIGURATION AND OPERATION MODES

THE MODES OF OPERATIONS ARE ILLUSTRATED IN TABLE 1.

Mode	S <sub>1</sub>	S <sub>2</sub>	<b>S</b> <sub>3</sub>	$S_4$	<b>S</b> <sub>5</sub>	S <sub>6</sub>	Generated power versus load demand
1	ON	ON	OFF	OFF	ON	OFF	P <sub>PV</sub> >P <sub>L</sub> & P <sub>bat</sub> <p<sub>max</p<sub>
2	ON	OFF	OFF	ON	ON	OFF	P <sub>PV</sub> >P <sub>L</sub> & P <sub>bat</sub> =P <sub>max</sub>
3	ON	OFF	ON	OFF	ON	OFF	$P_{PV} < P_L \& P_{PV} + P_{bat} > P_L$
4	ON	OFF	ON	OFF	ON	ON	P <sub>PV</sub> <p<sub>L &amp; P<sub>2</sub>+P<sub>3</sub><p<sub>4</p<sub></p<sub>

**TABLE 1.** FOUR DIFFERENT OPERATIONAL MODES OF THE PV, BATTERY BANK, AND UTILITY GRID SYSTEM

#### MODE 1:

IN THIS CASE AND BY USING FIGURE 2, THE PV OUTPUT POWER WILL FEED THE LOAD AND CHARGE THE BATTERY, WHERE PMAX IS THE MAXIMUM REQUIRED POWER FOR THE BATTERY (BATTERY IS FULLY CHARGED).

#### Mode 2

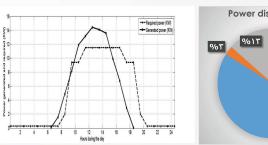
THE PV OUTPUT POWER WILL FEED THE LOAD AND FEED THE UTILITY GRID AS WELL. HENCE, THE BATTERY BANK IS FULLY CHARGED.

#### Mode 3

THE PV OUTPUT POWER AND THE BATTERY POWER WILL FEED THE LOAD AND THE REMAINING POWER WILL FEED THE UTILITY GRID.

#### MODE 4:

THE PV OUTPUT POWER, BATTERY AND THE UTILITY GRID WILL FEED THE LOAD.



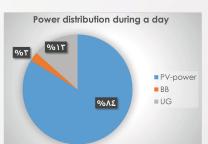


FIG. 2. GENERATED POWER FROM THE PROPOSED SOLAR SYSTEM FIG. 3. POWER DISTRIBUTION DURING A DAY BY THE PROPOSED SYSTEM.

#### **CONCLUSION**

HYBRID PV/BB/UG COMPLETE SYSTEM DESIGN AND IMPLEMENTATION HAS BEEN INTRODUCED. THE PERFORMANCE OF THE SYSTEM IS ILLUSTRATED FOR A LOAD OF, IN UBT UNIVERSITY IN JEDDAH, KSA, A NEW BUILDING WHICH IS CONSISTING OF TWO FLOORS AND EACH FLOOR CONSISTING OF SEVEN CLASS ROOMS WITH PROJECTOR IN EACH CLASS AND ONE CENTRAL AIR CONDITION. THE NET COST OF THE GENERATED POWER FROM THE INTRODUCED SYSTEM SAVES 343SR PER MONTH AND THE TOTAL SAVING FOR THE LIFE TIME OF THE SYSTEM IS 18,164 SR.

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# IMPROVEMENT OF HEALTHCARE SYSTEMS USING LEAN SIX SIGMA CONCEPTS IN SAUDI HOSPITALS

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#### **I**NTRODUCTION

Lean Six Sigma concepts gained a lot of attention in the healthcare systems. Lean thinking originally (and historically) was applied in Japanese production systems. If developed correctly, it would result in waste reduction in all aspects of the system leading to reduction in cost and an increase in profitability.

In few words Lean Manufacturing is a an established managerial philosophy with a proven track record in industry. [1]

On the Other hand Six Sigma philosophies have the ability to improve the system from the customer's point of view and affect the performance of the hospitals.

#### **EXPECTED OUTCOMES**

The researchers hope they are able to cover the following by the end of their research

- 1. Evaluation of the current health care sector in Saudi Arabia from a managerial and from a quality point of view
- 2. Identify the gaps in the sector, any differences among hospitals in the managerial style and level of quality
- 3. Develop a managerial model on how a Lean Six Sigma should be applied in the context of Saudi Hospitals.

#### **PROBLEM STATEMENT**

The current state of the Saudi Hospitals are unknown, up to the knowledge of the authors no work covered these concepts in a direct manner.

The problem statement can be summarized as following:

What is the level of readiness of Saudi Hospitals to apply Lean Six Sigma methodology?

What are the cultural barriers from applying such model for improving the health care system?

How to overcome these barriers?

#### **CONCLUSION AND FUTURE PERSPECTIVES**

Literature suggests that implementing lean Six Sigma have a lot of benefits as it Lean's concentration on cost reduction and efficiency is a perfect complement to Six Sigma's pursuit of accuracy and precision. [2]

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# An Image based method for Rendering Overlay Text Detection and Extraction Using Transition Map and Inpaint

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#### **ABSTRACT**

AN EFFICIENT IMAGE BASED METHOD OF OVERLAY TEXT BRINGS IMPORTANT SEMANTIC CLUES IN VIDEO CONTENT ANALYSIS SUCH AS VIDEO INFORMATION RETRIEVAL AND SUMMARIZATION, SINCE THE CONTENT OF THE SCENE OR THE EDITOR'S INTENTION CAN BE WELL REPRESENTED BY USING INSERTED TEXT. OVERLAY TEXT EXTRACTION FOR VIDEO OPTICAL CHARACTER RECOGNITION (OCR) BECOMES MORE CHALLENGING, COMPARED TO THE TEXT EXTRACTION FOR OCR TASKS OF DOCUMENT IMAGES, DUE TO THE NUMEROUS DIFFICULTIES RESULTING FROM COMPLEX BACKGROUND, UNKNOWN TEXT COLOR, SIZE AND SO ON. THIS PROPOSED SYSTEM SOLVES THE OVERLAY TEXT DETECTION, OCR PROCESS. FOR OVERLAY TEXT DETECTION TRANSITION MAP IS USED. FOR OCR PROCESS FONT MATCHING IS USED. THE MAIN AIM OF THE RESEARCH IS TO PROPOSE A NOVEL FRAMEWORK TO EXTRACT THE OVERLAY TEXT INFORMATION IN VIDEO FRAMES. THIS METHOD PRODUCES BETTER THAN THE PREVIOUS METHODS. RESULTANT ACCURACY IS HIGHLY IMPROVED.

#### SAMPLE OUTPUT



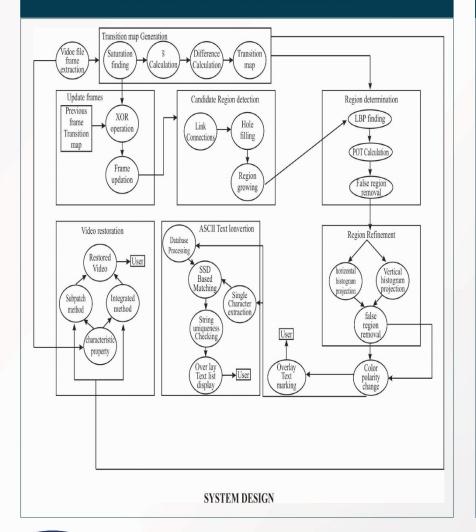
#### ORIGINAL FRAME (SAMPLE FRAME)



TRANSITION MAP



#### **RESULT AND DISCUSSION**



#### **FUTURE WORK**

THE PREVIOUS METHODS ARE NOT ROBUST TO DIFFERENT CHARACTER SIZE. BUT THE PROPOSED METHOD IS ROBUST TO DIFFERENT CHARACTER SIZE BECAUSE THIS IS WORKING BASED ON TRANSITION MAP CONCEPT. ANOTHER ADVANTAGE IS THE POSITION OF THE TEXT CAN BE PLACED ANYWHERE, THE TRANSITION MAP CAN INDICATE IT SUCCESSFULLY. THE PROPOSED SYSTEM IS ALSO ROBUST TO COLOR AND CONTRAST VARIANCE. IN THE PREVIOUS METHOD [5] THEY USE THE FRAME-UPDATE AFTER THE OVERLAY TEXT DETECTION. IT WILL TAKE MORE TIME. TO AVOID THIS OVER TIME TAKEN PROBLEM, THIS SYSTEM USES THE FRAME-UPDATE AT THE TIME CALCULATION OF TRANSITION MAP. THE PREVIOUS METHODS ARE NOT COMBINED WITH OCR PROCESS.

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# ASSESMENT OF QUALITY COSTS IN SAUDI ARABIA MANUFACTURING INDUSTRY

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#### **QUALITY COST DEFINED**

QUALITY COSTS ARE THOSE RESULTING FROM PRODUCING, IDENTIFYING, REPAIRING, AND AVOIDING DEFECTIVE PRODUCTS. THE FOLLOWING FOUR CATEGORIES ARE USED TO DEFINE AND QUANTIFY MANUFACTURING QUALITY COSTS:

First, internal failure costs which refers to these costs incurred prior to the products delivery to the customer. They include costs resulting from scrap, rework, retest, downtime, yield losses or disposition. **Second**, external failure costs which refers to these costs occurring after the products are delivered to the customer. They include categories such as

COMPLAINT ADJUSTMENT, RETURNED PRODUCTS, WARRANTY CHARGES, AND LIABILITY OR ALLOWANCES CONCESSIONS.

#### QUALITY COST DEFINED- CONT.

**THIRD**, APPRAISAL COSTS ARE THESE RESULTING FROM MEASURING, EVALUATING, AND AUDITING OF MATERIAL AND PRODUCTS TO DETERMINE

THEIR CONDITION AND CONFORMANCE TO SPECIFICATIONS. THEY INCLUDE COSTS OF INSPECTION AND TESTING OF INCOMING MATERIAL AND THROUGH PRODUCTION, ASSOCIATED MATERIAL AND SERVICES CONSUMED, AND INSTRUMENTS AND TESTING EQUIPMENT CALIBRATION. FOURTH, PREVENTIVE COSTS ARE THESE ASSOCIATED WITH ACTIVITIES AIMED AT REDUCING APPRAISAL AND FAILURE COSTS. THEY INCLUDE COSTS OF QUALITY PLANNING AND DESIGN, NEW PRODUCTS REVIEW, PROCESS CONTROL, TRAINING, QUALITY DATA ACQUISITION, ANALYSIS AND REPORTING, AND IMPROVEMENT PROJECTS.

#### **SURVEY DESIGN**

A survey of several manufacturing industries in Saudi Arabia will be conducted. The survey will include a cross representation of manufacturing activities existing in the region. They include construction material, light metal fabrication, plastics and glass products, and assembly of various electric & mechanical products and home appliances.

#### **C**ONCLUSION

The survey is intended to assess the level of awareness and quantitative estimates of quality costs as related to the above four categories. The survey design and findings will be presented along with analysis. Specific conclusions will be drawn regarding quality costs studies and reduction/improvements programs as related to the surveyed industry categories.

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# REDUCING EVAPORATION FROM LARGE FRESH WATER RESERVOIRS IN SAUDI ARABIA USING MONO LAYERS NANO TECHNOLOGY

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#### **SUMMARY**

MONOLAYERS WILL BE USED TO COVER STANDING WATER SOURCES, SUCH AS DAMS AND LAKES BY MEANS TO REDUCE THE LOSS OF WATER BY REDUCING THE EVAPORATION RATE. LABORATORY EXPERIMENTS WILL BE CARRIED OUT TO IDENTIFY AND QUANTIFY THE DESIRED MONOLAYER COMPOUNDS (LONG CHAIN FATTY ALCOHOLS, ESPECIALLY 1-HEXADECANOL (CETY L ALCOHOL) AND 1-OCTADECANOL (STEARY L ALCOHOL) TO UNDERSTAND THE MECHANISM BY WHICH MONOLAYERS REDUCE WATER EVAPORATION IN TERMS OF EVAPORATION SUPPRESSION.

NANO TECHNOLOGY CAN BE USED TO PRODUCE CHEMICAL NANOTHIN FILMS OF MONOLAYERS FOR BETTER AND EFFECTIVE PERFORMANCE THAN THE ULTRA-THIN FILM PRODUCTS TO REDUCE THE AMOUNT OF WATER EVAPORATION FROM LARGE WATER STORAGES, THEREBY INCREASING WATER SAVINGS. THESE CHEMICALS NEED TO BE FORMED INTO A PHYSICAL PRODUCT, AND TO UNDERGO EXTENSIVE PERFORMANCE TESTING IN THE LABORATORY, AND IN SMALL- AND LARGE-SCALE FIELD TRIALS.

LABORATORY STUDIES ARE HELPING IN SELECTING AND DEVELOPING NEW NANO MATERIALS CAPABLE OF REDUCING WATER EVAPORATION IN SAUDI ARABIA BY PROVIDING FIELD TEST OF THEIR EFFECTIVENESS AGAINST THE SURROUNDING FACTORS SUCH AS TEMPERATURE AND WIND IN WATER EVAPORATION SAVINGS WHEN USED ON LARGE FRESH WATER RESERVOIRS.

If the Nano monolayers technology is successful, the water savings from large fresh water storages could be more than 400 Million cubic meter per year in Saudi Arabia

#### RESEARCH OBJECTIVES

TO DEVELOP A NOVEL NANO-THIN FILM TECHNOLOGY CAPABLE OF INCREASING THE VIABILITY OF MONOLAYERS BY OVERCOMING THE RECOGNIZED LIMITATIONS.

To quantify the performance of Nano-thin film evaporation suppressants in reducing evaporation.

To assess the effectiveness of the Nano technology to reduce water evaporation and to determine whether it is an improvement over previous technologies.

To compare the evaporation suppressing capabilities of different Nano-thin film evaporation suppressants.

#### **I**NTRODUCTION

THE KINGDOM OF SAUDI ARABIA HAS AN AREA OF ABOUT 2.25 MILLION KM2, MOST OF WHICH IS LOCATED IN ARID REGIONS. THE AVAILABLE SURFACE WATER AND GROUNDWATER RESOURCES ARE LIMITED, PRECIPITATION RATES ARE LOW, AND EVAPORATION IS HIGH. THE ANNUAL RUNOFF IN THE KINGDOM IS ESTIMATED TO BE ABOUT 2,230 MILLION M3. THERE ARE MORE THAN 400 DAMS, WITH A TOTAL STORAGE CAPACITY OF 1900 MILLION M3.

EVAPORATION FROM WATER STORAGES IS A MAJOR ISSUE AFFECTING SURFACE WATER RESOURCES IN SAUDI ARABIA. ANNUAL WATER LOSSES BY EVAPORATION POTENTIALLY EXCEED 40 PER CENT OF WATER STORED. LOSS OF THIS WATER CAN LEAD TO REDUCED AGRICULTURAL PRODUCTIVITY AND CAN ADVERSELY AFFECT THE ENVIRONMENT. THE FIELD OF NANOTECHNOLOGY IS ONE OF THE MOST POPULAR AREAS FOR CURRENT RESEARCH AND DEVELOPMENT IN BASICALLY ALL TECHNICAL DISCIPLINES. IN THE AREA OF NANOTECHNOLOGY, MONOLAYERS AND POLYMER MATRIX BASED NANOCOMPOSITES HAVE GENERATED A SIGNIFICANT AMOUNT OF ATTENTION IN THE RECENT LITERATURE. OFTEN MAJOR DISCOVERIES TAKE SEVERAL DECADES TO REACH LARGE COMMERCIAL IMPACT AS THE COST/PERFORMANCE VARIABLES UPON DISCOVERY ARE OUTSIDE THE REALM OF COMMODITY UTILITY AND ADDITIONAL ADVANCES ARE REQUIRED TO ACHIEVE AN ECONOMICALLY COMPETITIVE POSITION. SUCH IS THE CASE WITH THE TECHNOLOGIES BEING DEVELOPED WITH POLYMER-BASED NANOCOMPOSITES. WHILE MANY OF THE APPLICATIONS BEING COMMERCIALIZED TODAY WILL REMAIN SPECIALTIES, THERE ARE AREAS WHERE THE SPECIALTY POLYMER NANOCOMPOSITES OF TODAY WILL BE THE COMMODITIES OF THE FUTURE. AN AREA WHERE NANOCOMPOSITES COULD ACHIEVE A DRAMATIC COMMERCIAL PROMINENCE AS ADVANCED COMPOSITES CAN BE USED TO WATER SAVING OF EVAPORATION LOSSES FROM LARGE FRESH WATER STORAGES IN SAUDI ARABIA

#### **CONCLUSION AND FUTURE PERSPECTIVES**

The Research results will be applied on a total fresh water storage capacity of 1900 Million m<sup>3</sup> in Saudi Arabia. The water savings from water storages could be more than 400 Million cubic meter per year in Saudi Arabia.

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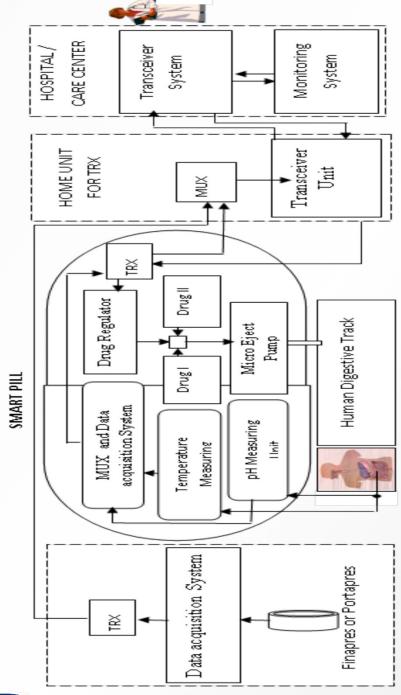


#### Introduction

Home Health care is a hot research field in the 21 century. It can reduce the risky and critical cases that may happen to elder and disabled patients. It also improves life quality of patients in their familiar environment. On the other hand, home health care will reduce the medical expense. With the help of the sophisticated communication techniques, widespread applied computers and microcomputers, and micro electro- mechanical systems, as sensing elements and actuators, home health care network has become a reality. Many researches went for excellent applicable results that are used nowadays in many hospitals. These hospitals are equipped with what is called "hospital monitoring centre", which receives a 24 hours precise measured data from the patients at their home directly.

IN THIS PAPER, A MODIFIED SMART PILL (SP) AND A FINGER RING ARE USED TO COMPLETE HEALTH CARE CONTROLLING SYSTEMS. THE COMPLETE SYSTEM IS VERY IMPORTANT IN SITUATION WHEN THE PATIENTS ARE IN AN UNCONTROLLED STATE. THE BLOCK-DIAGRAM OF THE ALREADY EXISTING HEALTH CARE SYSTEM AND THE BLOCK-DIAGRAM OF THE MODIFIED HEALTH CARE SYSTEM WILL BE SHOWN. PATIENTS AND ELDER PEOPLE SWALLOW THESE PILLS EVERYDAY AND LIVE NORMALLY. IN CASE OF EMERGENCY WHEN THEY ARE DISABLES, DOCTORS IN THE HOSPITAL OR CENTERS WHILE MONITORING THEM CAN SENT A CODED SIGNAL THAT IS RECEIVED BY THE PILL TO RELEASE THE PRECISE AMOUNT OF REQUIRED MEDICINE FOR THE CASE. THIS STEP SAVES THE TIME UP TO 30 MINUTES (ACCORDING TO EUROPEAN STANDARDS) OF SENDING THE CARE AMBULATORY TEAM TO THE PATIENT LOCATION.

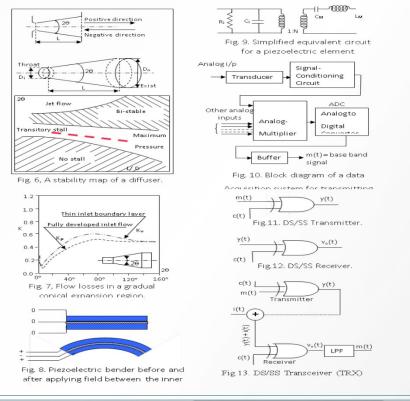
# HOSPITAL MONITORING SYSTEM WITH SP AND ADVANCED COMMUNICATION SYSTEM.





Fig, 14. Hospital Monitoring System with

SP and Advanced Communication System.



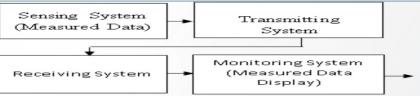


Fig. 15. Hospital Monitoring System

#### CONCLUSION AND FUTURE PERSPECTIVES

THIS PAPER PRESENTS A MODIFIED HEALTH CARE CONTROLLING SYSTEM. THE SYSTEM DESCRIBED HERE PROVIDES MEASUREMENTS OF TEMPERATURE AND PH BY USING A NEW PROPOSED SP AND BP BY USING A FINGER RING OF A PATIENT AT HOME AND TRANSMITS THIS DATA TO A HEALTH CARE CENTER OR HOSPITAL MONITORING SYSTEM. THE TRANSMISSION OF DATA IS DONE BY A SECURE WIRELESS SPREAD SPECTRUM TECHNIQUE. IN CASE OF EMERGENCY WHEN THE PATIENT AT HOME SUFFERS ANY SERIOUS PROBLEM, THE DOCTORS AT HEALTH CARE CENTER SENT A CODED CONTROLLING SIGNAL. THIS SIGNAL IS TRANSMITTED TO THE TRANSCEIVER OF THE SP INSIDE THE DIGESTIVE TRACK OF THE PATIENT, WHICH IN TURN RELEASES AN ADEQUATE AMOUNT OF DRUG / DRUGS THAT HELP TO IMPROVE THE PATIENT CASE UNTIL THE AMBULATORY TEAM ARRIVES.

THE SP TRANSCEIVER TRANSFORMS RECEIVED SIGNAL INTO VOLT. THIS VOLT ACTUATES THE MICROPUMP PIEZOELECTRIC DIAPHRAGM. THE DIAPHRAGM DEFORMS IN A SINUSOIDAL FORM WITH A SPECIFIED AMPLITUDE CAUSING SUCTION OF PRESCRIBED DRUG FROM RESERVOIR AND EJECTS IT INSIDE THE DIGESTIVE TRACK OF THE PATIENT. THE PRECISE AMOUNT OF DRUG / DRUGS IS PREDETERMINED ACCORDING TO THE RECEIVED SIGNAL FROM THE HEALTH CARE DOCTORS. FEEDBACK BY THE SP TRANSCEIVER UNIT TO THE DOCTOR IS PERFORMED TO ASSURE THE NECESSITY OF SENDING THE AMBULATORY TEAM OR NOT. THIS INTEGRATING MODIFIED SYSTEM WORKS WELL IN A CIRCLE OF FEW KILOMETRES AROUND THE HEALTH CARE CENTER AND HELPS SAVING LIFE OF ELDER AND DISABLES PATIENTS.

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# Novel Passive Radio Frequency Identification System

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#### Introduction

RADIO FREQUENCY IDENTIFICATION (RFID) IS A WIRELESS TECHNOLOGY THAT ALLOWS SMALL AND CHEAP CHIPS TO BE USED IN REMOTE SENSING AND INTERROGATION IN ORDER TO EXCHANGE IDENTIFICATION AND LOCATION INFORMATION BETWEEN A READER AND TAGS. IT IS SUPPOSED TO ULTIMATELY REPLACE THE WIDELY USED OPTICAL BARCODE TECHNOLOGY FOR SOLVING LOGISTICAL AS WELL AS LARGE DATA HANDLING CHALLENGES. IT ENABLES SOLUTIONS FOR MANAGING HIGH NUMBERS OF GOODS WHILE MAINTAINING FLEXIBILITY AND EASE OF USE.

THE IDEA OF THIS PROJECT HAS BEEN MOTIVATED IN JUNE 2013, AND THE PROJECT IS PLANNED TO CONTINUE UNTIL NOVEMBER 2017. THE LAUNCHING OF THIS PROJECT WAS SUPPORTED BY DAAD SINCE A STUDY VISIT WAS GRANTED FOR THE PRIMARY INVESTIGATOR TO SPEND THREE MONTHS IN THE INSTITUTE OF DIGITAL SIGNAL PROCESSING (DSV) AT UNIVERSITY OF DUISBURG-ESSEN (UDE) IN THE PERIOD BETWEEN 01.06.2013 AND 31.08.2013, IN WHICH RESEARCH WORK PLANNING WAS DONE.

#### **WORK PACKAGES**

The project consists of **5** work packages. The first **3** work packages have been accomplished by the end of the year **2015.** The work schedule was planned for **54** months as following:

#### WORK PACKAGE 1 (01.06.2013 - 31.12.2013):

WP1: LITERATURE REVIEWING, RESEARCH WORK PLANNING, AND APPLYING FOR FUND.

#### WORK PACKAGE 2 (01.01.2014 - 31.12.2014):

WP 2:RFID reader testbed realization and protocol implementation.

#### WORK PACKAGE 3 (01.01.2015 - 31.12.2015):

WP 3: Investigations and testing of RFID reader testbed.

#### WORK PACKAGE 4 (01.01.2016 - 31.12.2016):

WP 4: RFID CHIPLESS TAG REALIZATION AND PROTOCOL IMPLEMENTATION.

#### WORK PACKAGE 5 (01.01.2017 - 30.11.2017):

WP 5:BUILDING INITIAL PROTOTYPE OF ENHANCED PASSIVE RFID SYSTEM.

It is intended to apply for a research fund from  $\ensuremath{\mathsf{UBT}}$  to accomplish  $\ensuremath{\mathsf{WP4}}.$ 



## CONFIDENTIAL

## Design and Methodology

The basic units of an RFID system are the tag, the reader, and the data processing subsystem (host computer) as shown in Figure 1. RFID system with chipless tags is similar to RADAR system in its operation. The reader transmits an electromagnetic signal in its interrogation zone and the tag responds by backscattering the signal. Each tag has its own spectral signature defined in terms of frequency resonance information. The reader then captures the backscattered signal and determines the tag identity from the spectrum of the signal.

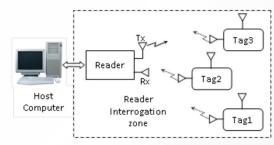


FIGURE 1: TYPICAL RFID SYSTEM

THIS RESEARCH STARTED WITH THE ANALYSIS OF SEVERAL CURRENT NEEDS AND PROBLEMS FOR WHICH PASSIVE RFID TECHNOLOGY COULD BE A PROMISING SOLUTION, TECHNICALLY FEASIBLE, REASONABLY CHEAP, AND EASILY DEPLOYABLE. FOR EXAMPLE, THE NEEDS OF REPLACING OPTICAL BARCODE TECHNOLOGY USED IN SUPERMARKETS WITH RFID TECHNOLOGY WAS STUDIED. HERE THE GOODS IN THE SUPERMARKET ARE SUPPLIED WITH VERY CHEAP RFID PASSIVE TAGS TO TRACK ITS POSITION AND TO PROVIDE A FAST CHECKUP MECHANISM AT THE EXIT TO CALCULATE THE PRICE OF BOUGHT WARES BY CUSTOMERS. IN SUCH A SYSTEM SEVERAL CHALLENGES NEED TO BE SOLVED, E.G. ANTI-COLLISION PROTOCOLS AND SECURITY PROTOCOLS AS WELL AS DIGITAL SIGNAL PROCESSING TECHNIQUES.

Then an RFID reader testbed was designed. This RFID testbed requires the so-called "USRP N210 units" to control the access of the RF frontend units and antennas that can read many types of passive tags. PC or laptops are needed also to handle the commercially available USRP units. One PC can handle two USRP units via a Gigabit Ethernet-Switch, since the GNU radio implementation is working on 3MSamples/s. We were able to program USRP N210 units to work as an RFID reader by the end of 2014 and it does the work that the commercial readers do. This was a very important step since we now have the ability to modify the software of the reader to achieve our research goals. Finally, it is intended now to design and develop a new chipless tag that should be extremely cheap.

#### **CONCLUSION AND FUTURE PERSPECTIVES**

THE NEW TAG WILL NEED THE DEVELOPMENT OF NEW PROTOCOLS FOR READING MULTIPLE TAGS SIMULTANEOUSLY. AS A RESULT, IT IS EXPECTED TO HAVE A PROGRAMMABLE READER THAT CAN READ NEW CHIPLESS TAGS OF OUR DESIGN, AND THIS WILL OPEN THE WAY FOR BUILDING AN INITIAL PROTOTYPE OF AN ENHANCED PASSIVE RFID SYSTEM.

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#### MODELLING VAN DER WAALS INTERACTIOWATER MOLECULES AND BIOLOGICAL CHANNELS

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This work has been done by Dr. Hakim Garalleh

#### Introduction

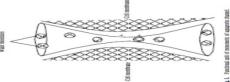
Full article: Al Garalleh, H., Thamwattana, N., Cox, B. J. & Hill, J. M. (2013). MODELLING VAN DER WAALS INTERACTION BETWEEN WATER MOLECULES AND BIOLOGICAL CHANNELS. JOURNAL OF COMPUTATIONAL AND THEORETICAL Nanoscience, 10 (11), 2722-2731.

- \* WE EXAMINE THE VAN DER WAALS INTERACTIONS BETWEEN WATER MOLECULES WITH BOTH WATER CHANNELS, AQUAPORIN-Z (AQPZ) AND GLYCEROL CHANNEL
- \* Here we model these problems using classical applied mathematics and OBTAIN THE POTENTIAL ENERGY FOR A WATER MOLECULE INTERACTING WITH THE CHANNELS WHICH WE ASSUME IN BOTH CASES TO HAVE A FLAIRED RIGHT CYLINDRICAL
- \* WE MODEL A WATER MOLECULE AS COMPRISING TWO PARTS: FIRSTLY AS A SINGLE POINT REPRESENTING THE LOCATION OF THE OXYGEN ATOM, AND A SPHERICAL SHELL OVER WHICH WE ASSUME A UNIFORM DISTRIBUTION OF THE TWO HYDROGEN ATOMS.
- \* OUR RESULTS INDICATE THE SPONTANEOUS ACCEPTANCE OF WATER MOLECULES INTO THESE CHANNELS.

#### INTRODUCTION:

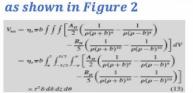
- \* AQUAPORINS FROM HUMAN CELLS WERE DISCOVERED IN 1992 AND SINCE THEN SEVERAL AQUAPORIN PROTEIN VARIANTS HAVE BEEN IDENTIFIED [1]
- \*AQUAPORINS FACILITATE THE TRANSPORT OF WATER AND SMALL SOLUTES, SUCH AS SUGARS, INOS AND GASES ACROSS CELL MEMBRANES [2, 3] AS SOWN IN FIGURE 1
- \*Modern homologous biology have postulated that there are at least 10DISTINCT MAMMALIAN AQUAPORINS NOW KNOWN [5, 6] AND CLASSIFIED INTO TWO MAIN SUBGROUPS: WATER-SELECTIVE CHANNELS (ORTHODOX-AQUAPORINS) AND THEOTHER CHANNELS PERMEABLE BY WATER, GLYCEROL, AND OTHER SMALL MOLECULES [4, 7-9]

IN OUR MODEL, WE ANALYZE H2O-AQPZ AND H2O-GLPF INTERACTIONS BY ADOPTING A GEOMETRY OF FLAIRED RIGHT CYLINDER FOR THE AQPZ AND GLPF CHANNELS AND A DISCRETE POINT AND CONTINUOUS SPHERICAL SHELL FOR THE WATER MOLECULE, AND EXAMINE THE ACCEPTANCE OF THE WATER MOLECULE INTO THESE CHANNELS.

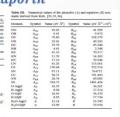


#### **DISCUSSION AND RESULTS**

**2**– The oxygen atom as an arbitrary point on the z – axiz interacting with flaired right cylindrical aquaporin



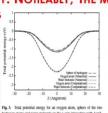


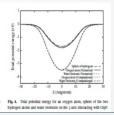


#### **S**OME OF THE PHYSICAL PARAMETERS:

As shown in Figures 3 and 4, water molecules will be accepted inside BOTH WATER CHANNELS, AQPZ AND GLPF. NOTIEABLY, THE MAGNITUDE OF INTERACTION ENERGY WATER-GLPF IS G

THAT OF WATER-AQPZ BECAUSE OF THE INNER RADIUS OF AQPZ **CHANNEL BEING NARROWER THAT** OF GLPF





#### **MATHEMATICAL MODEL:**

- \* We begin by considering the Lennard-Jones interaction between a water channel (EITHER AQPZ OR GLPF CHANNEL) WITH AN ARBITRARY POINT LOCATED ON THE Z-AXIS, AND WE TREAT THE AQPZ AND GLPF CHANNELS AS FLAIRED RIGHT CYLINDERS. WE INTRODUCE A RECTANGULAR COORDINATE SYSTEM (x, y, z) AS A REFERENCE SYSTEM AND WE DEFINE A CYLINDRICAL SHELL WITH AN ORIGIN LOCATED AT THE CENTRE OF THE CYLINDER, PARAMETRISED BY  $(rcos\theta, rsin\theta, z)$ , where  $\theta \in [-\pi, \pi]$ ,  $z \in [-L/2, L/2]$ ,
- $\delta \in [a, 1]$  AND 0 < a < 1. WE DEFINE r BY THE QUADRATIC EQUATION:

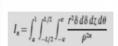
$$r = r_0 + 4 (r_1 - r_0) (\frac{z}{L})^2$$
 and  $a = \frac{r_0^*}{r_0} = 0.25$ 

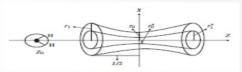
WHERE  $r_1$ : the inner radius and  $r_0$ : the inner radius

THE DISTANCE BETWEEN A TYPICAL POINT IN THE FLAIRED CYLINDRICAL VOLUME AND THE OXYGEN ATOM AS AN ARBITRARY POINT  $(0, 0, Z_0)$  IS GIVEN BY  $\rho = (r\delta cos\theta)^2 + (r\delta sin\theta)^2 + (Z - Z_0)^2 = r^2\delta^2 + (Z - Z_0)^2$ 

WE MODEL A WATER MOLECULE AS COMPRISING TWO PARTS:

1 - The oxygen atom as an arbitrary point on the z - axizinteracting with flaired right cylindrical aquaporin as shown in Figure 2





Attractive constant  $A = 4 \epsilon \sigma^6$ 

and Repulsive contant  $B = 4 \epsilon \sigma^{12}$ 

ε: wall depth and σ: van der Waals distance

 $\epsilon_{12} = \sqrt{\epsilon_1 \epsilon_2}$  and  $\sigma_{12} = (\sigma_1 + \sigma_2)/2$  [10-12]

#### **CONCLUSION AND FUTURE PERSPECTIVES**

- \* In this paper, we present a mathematical model which describes the interaction BETWEEN A WATER MOLECULE AND FLAIRED RIGHT CYLINDRICAL WATER CHANNELS.
- \* THE LENNARD-JONES POTENTIALIS USED TO CALCULATE THE VAN DER WAALS POTENTIAL
- \* OUR RESULTS SHOW THAT THE TOTAL POTENTIAL ENERGY HAS A MINIMUM ENERGY INSIDE THESE CHANNELS BUT A LOCAL MINIMUM AT THE CENTRE OF THE AQUAPORIN DUE TO THE NARROWING OF THE RADIUS R OF AQUAPORIN.
- \* CALCULATIONS SHOW THAT THE ACCEPTANCE CONDITIONS ARE SATISFACTORY AND ALLOW WATER MOLECULE TO BE ACCEPTED INSIDE OF THESE CHANNELS.
- FUTURE DIRECTIONS WILL BE TO INVESTIGATE THE POTENTIAL ENERGY FOR INDIVIDUAL BIO-MOLECULES, SUCH AS CALCIUM CHLORIDE AND AMMONIA MOLECULES INTERACTING WITH
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## QUANTUM DOTS SENSITIZED SOLAR CELLS

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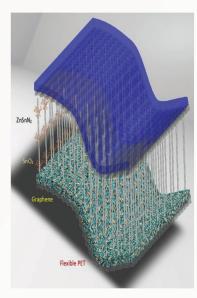




King Abdullah University of Science and Technology



#### Nanowire Based Quantum Dots SENSITIZED SOLAR CELLS (QDSCCs)



Abstract: Being clean , abundant and renewable, Solar energy is very promising in renewable energy conversion process. This research is about 3<sup>rd</sup> generation solar cells, using zero and one dimensional nanostructures.

#### The objectives are the following:

Develop a 3<sup>rd</sup> generation • solar cell

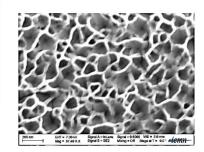
Increase the conversion • efficiency

Develop an eco-green • flexible Solar cell

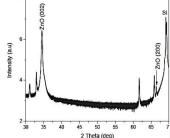
Decrease the • manufacturing cost

**ZNO / PBS RADIAL JUNCTION FOR QDSCCs** 

#### Proof of concept



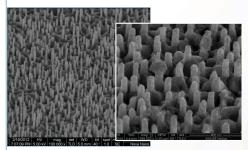


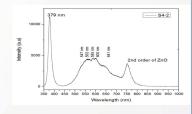


Sem top View of Seed layer of Honeycomb structure,

XRD spectrum of ZnO Seed Layer deposited at low Pressure

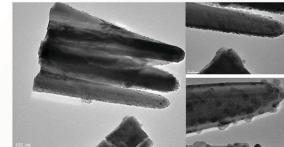
The Seed layer is textured and highly crystalline in the c-axis direction (002) plane





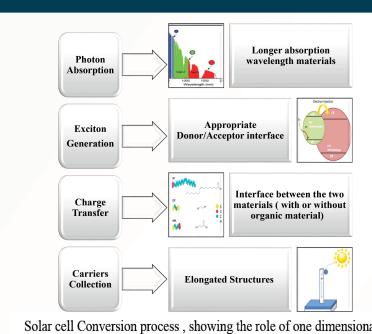
Tilted view SEM of ZnO Nanowires decorated with PbS QDs

PL Spectra showing showing a sharp peal in at 379 nm which correspond to ZnO and broad weal peaks in the visible zone between 540 nm and 641 nm).



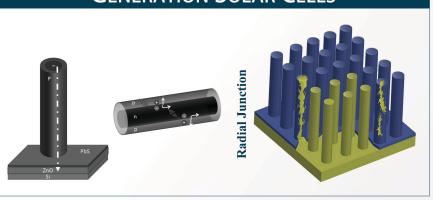
TEM images confirm the deposition of PbS QDs on the lateral and top sides of the nanowires ranging from 6 nm- 13.5 nm.

#### **SOLAR CELL CONVERSION PROCESS**

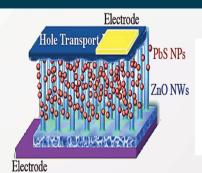


Solar cell Conversion process, showing the role of one dimensional (1D), nanowires and zero dimensional (0D) Nanoparticles.

### RADIAL JUNCTION, NANOWIRES BASED 3RD **GENERATION SOLAR CELLS**



### **CONCLUSION & FUTURE PERSPECTIVE**



☐Find an alternative to PbS □I-V in the dark and under 1 sun illumination ☐ Incident photon to current conversion efficiency **IPCE** 

□ Photocurrent – voltage ( $J_{sc}$  (mA/cm<sup>2</sup>),  $V_{0c}$  (mV), FF, and efficiency)

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# THE IMPACT OF VARIATION ORDERS ON A PROJECT PROGRESS IN THE SAUDI HOSPITALS CONSTRUCTION INDUSTRY; CASE STUDIES DR. JAWAD AL SULIMAN

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#### INTRODUCTION

Variation orders play a crucial function in the success or FAILURE OF DELIVERING THE CONSTRUCTION PROJECTS. BAXENDALE and Schofield (1986) define variation orders simply as any CHANGE THAT CAN OCCUR TO THE BASIS WHICH IS DIFFERENT THAN THE AGREED AND SIGNED CONTRACT.

IN FACT, IT HAS BEEN ARGUED BY REVAY (2002) THAT THERE WILL CERTAINLY BE VARIATION ORDERS IN EACH SINGLE CONSTRUCTION PROJECT IN ITS LIFECYCLE TO DESIGN, TIME, COST AND QUALITY, IN MOST OF THESE PHASES, IF NOT ALL.

THE CONSTRUCTION INDUSTRY THEREFORE IS SUBJECT TO POOR PERFORMANCE DUE TO RELATED TO DESIGN AND CONSTRUCTION QUALITY THAT MAY CAUSE THE OCCURRENCE OF VARIATION ORDERS WHICH LEADS TO TIME DELAY AND COST OVERRUNS (WONG ET AL, 2007).

THIS STUDY FOCUSES ON THE IMPACT AND INFLUENCES OF CHANGE ORDERS IN CONSTRUCTION PROJECTS IN A SPECIFIC PERIOD, I.E. THE CONSTRUCTION PHASE. THE STUDY IS ALSO LIMITED IN CONTEXT TO THE KINGDOM OF SAUDI ARABIA. MOREOVER, THIS RESEARCH IS RESTRICTED TO A CASE STUDY COMPARING TWO HOSPITAL PROJECTS: SKAKA HOSPITAL AND BALJURASHI HOSPITAL.

#### **AIM AND OBJECTIVES**

THIS RESEARCH AIMS TO FIND OUT THE IMPACT OF VARIATION ORDERS IN A CONSTRUCTION PROJECT DURING THE CONSTRUCTION PHASE IN THE SAUDI HOSPITALS CONSTRUCTION INDUSTRY AND THE **OBJECTIVES ARE AS FOLLOWS:** 

TO IDENTIFY THE CAUSES OF VARIATION ORDERS AND THEIR IMPACT ON A CONSTRUCTION PROJECT IN TERMS OF COST, TIME AND QUALITY.

TO REDUCE THE AMOUNT OF VARIATION ORDERS ON A CONSTRUCTION PROJECT AS MUCH AS POSSIBLE IN ORDER TO ELIMINATE THE NEGATIVE CONSEQUENCES.

TO PROVIDE A BEST PRACTICE TO AVOID THE PROBLEMS ASSOCIATED WITH VARIATION ORDERS IN THE MINISTRY OF HEALTH'S FUTURE CONSTRUCTION PROJECTS.

#### **METHODOLOGY**

TO ACHIEVE THE AIM AND THE OBJECTIVES, TWO CASE STUDIES WERE CARRIED OUT: SKAKA HOSPITAL AND BALJURASHI HOSPITAL. THE CASE STUDIES WERE GEARED TOWARDS STUDYING THE VARIATION ORDERS. VARIOUS VARIATION ORDERS OCCURRED IN THE TWO CASES WHICH WERE CATEGORISED INTO FOUR CATEGORIES IN TERMS OF:

- A) TYPE OF THE VARIATION ORDER,
- B) SOURCE OF THE VARIATION ORDER,
- C) WHETHER THE ITEM OF THE VARIATION ORDER IS INCLUDED IN THE CONTRACT OR NOT AND
- D) THE CAUSES OF THE VARIATION ORDER.

#### **CONCLUSION AND FUTURE PERSPECTIVES**

RESULTS OF THE RESEARCH INDICATED THAT THE VARIATION ORDERS THAT HAPPENED IN THE TWO PROJECTS LED TO DELAYS IN COMPLETION AND COST OVERRUNS. THIS RESEARCH CONCLUDES THAT VARIATION ORDERS HAVE A SIGNIFICANT IMPACT ON PROJECT TIME AND COST.

IT IS RECOMMENDED FOR THE MINISTRY OF HEALTH TO CONDUCT SOME PROCEDURES TO OBTAIN THE OPTIMUM METHOD IN CONSTRUCTING THEIR PROJECTS, NAMELY (A) SITE INVESTIGATIONS HAVE TO BE CONDUCTED BEFORE LAUNCHING A CONSTRUCTION PROJECT, (B) EARLY INTRODUCTION OF THE PROJECT MANAGER CAN HELP TO ACHIEVE SUCCESS IN MOST PROJECTS, (C) THE CLIENT'S REQUIREMENTS AND NEEDS SHOULD TO BE CLEAR IN TERMS OF SPECIFICATIONS, TIME, COST, AND QUALITY AS WELL AS THE SCOPE OF THE PROJECT AND LIMITATIONS, (D) THE SIGNED CONTRACT MUST BE FULLY REVIEWED AND STUDIED AS REGARDS TO TERMS AND CONDITIONS, SPECIFICATIONS AND BILLS OF QUANTITIES AND MORE ATTENTION NEEDS TO BE PAID TO THE BUILDING SERVICES AND QUANTITY SURVEYING

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