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Editorial

Achieving 99% efficiency used to be a hypothetical thing. But, the design and analysis of DC-DC converters for low-power Photovoltaic (PV) energy harvesting applications such as Wireless Sensor Network (WSN) Nodes have realized the figures. The WSN nodes consume power due to their use in continuous monitoring and control applications. From simulation results for the same it is observed that in DC-DC converters the desired output voltage can be obtained by proper selection of component values of Inductor, capacitor and switching frequency.

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. We have a proposal for a classification-based face detection method using Gabor filter features. Considering the desirable characteristics of spatial locality and orientation selectivity's of the Gabor filter, the design filter is used for extracting facial features from the local image. The effectiveness of the proposed method is demonstrated by the experimental results on testing a large number of images and the comparison with the state-of-the-art method. This increases its ability to generalize. The different structuring elements can be tested and verified for number of images for future researchers and scientists.

Face Recognition is a majorly required feature now- a days. We will represent a classification-based face detection method using Gabor filter features. Considering the desirable characteristics of spatial locality and orientation selectivity's of the Gabor filter, the design filter is used for extracting facial features from the local image. The feature vector based on Gabor filters is used as the input of the classifier, which is a Feed Forward neural network (FFNN) on a reduced feature subspace learned by an approach simpler than principal component analysis (PCA). The effectiveness of the proposed method is demonstrated by the experimental results on testing a large number of images and the comparison with the state-of-the-art method.

An innovatory product with user acceptance providing with serenity, convenience, timelines and efficiency in day-to-day life. People purchase different items from a supermarket and put them in trolley. After purchasing, one needs to go to billing counter for payments. At billing counter the cashier prepare the bill using QR Code Reader which is very time consuming process and results in long queue at billing counter. The idea for the project is to optimise this process of shopping at a retail store, by enabling the customer to handle the check-out process. The approach to automated shopping and billing until now has been more hardware-centric.

Depleting fossil fuels and alarming environmental concerns have propelled the mankind to explore for non- conventional energy source such as solar energy, wind energy, among others. Since, countries like India receive direct sunlight through out the year therefore, an approach emphasizes on use of solar powered energy to solve the energy crisis.

Coastal sediment data analyses play a role in understanding coastal habitat and help determine the extent, nature, and transport of pollutants. Sediment data assist in determining sources of appropriate material for beach replenishment, and are an integral data layer in GIS analysis of coastal environments for a variety of purposes."In addition to key environmental analysis and assessment roles, sea floor

studies have other economic value. Sediment properties are crucial in placement of seabed cables, data from exploratory wells are necessary to evaluate sites for offshore drilling, and geochemical studies are necessary for evaluation of offshore hard mineral resources.Accurate classification of seabed or riverbed is important in many more applications like dradging, study of marine biology, coastal engineering, hydrography etc. Numerous methods have already been proposed for seabed classification. In this issue, we presented a method to classify a given side scan SONAR images depending on type of sediment such as sand, mud, rock etc. We evaluated our proposed methods with four different kernels as linear, quadratic, polynomial, GRB and found that the GRB kernel achieves the highest classification accuracy as 99.67%.

Preface

Dear Researchers,

We take this opportunity to welcome you all to the Volume No 5, Issue No. 2 of International Journal of Communications & Electronics (KIET - IJCE). This journal will provide a forum for in depth and substantial discussions on the theory, design and implementation of the emerging technologies in Communications, Networking, Microwave and Electronics techniques, thus providing solutions and strategies for business resilience.

It gives us an immense pleasure to have an amalgam of researchers from the fields of Communication Engineering, Electronics, and related technologies. The purpose of the Journal is to provide a platform to foster interdisciplinary communication among the delegates and to support the sharing process of diverse fields in various concepts and principles related to these domains.

Our appreciation also goes to entire team whose dedication and timeless efforts have gone for number of days for the second issue of the Journal.

Editors

Message

I am delighted to note that the Department of Electronics and Communication Engineering, KIET Group of Institutions, Ghaziabad is introducing Volume No 5, Issue No. 2 of International Journal of Communications and Electronics (KIET - IJCE).

I appreciate the efforts on the part of the Editorial Committee in bringing out an issue on Communications, Networking, Microwave and Electronics techniques.

I understand that the papers contributed for publication in the Volume No 5, Issue No. 2 are on almost all the current aspects of Communication Systems, Electronics systems, Microwave Engineering, Signal Processing & Applications, Networking Technologies and several others.

I have great pleasure in congratulating the Editors of this issue of KIET - IJCE for their untiring efforts in bringing out this third Volume No 5, Issue No. 2 of KIET-IJCE which will be a valued treasure for all who pursue research in Communications, Networking, Microwave and Electronics Engineering areas.

Let me close with warmest regards.

Dr. Anil Ahlawat
Director
KIET

Message

It gives me immense pleasure in writing this foreword for the Volume No 5, Issue No.2 of the KIET International Journal on Communications and Electronics (KIET - IJCE). This journal is targeted towards researchers, professionals, educators and students to share innovative ideas, issues, recent trends and future directions in the fields of Electronics and Communication Engineering.

The Volume No 5, Issue No. 2 of the journal KIET-IJCE includes papers on the theory, design and implementation of the emerging technologies in the field of Communications, Networking, Microwave and Electronics techniques. Furthermore, it will enable the researchers in various domains to foster the exchange of concept, protypes, research ideas and the results of research work which could contribute to the academic arena and also befit business and industrial community.

Dr. Sanjay Sharma
Editor – in - chief
KIET - IJCE

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A 99% Efficient, 3 volts Solar Energy Harvesting System for Wireless Sensor Network Nodes

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Abstract- **This paper focuses on design and analysis of DC-DC converters for low-power Photovoltaic (PV) energy harvesting applications such as Wireless Sensor Network (WSN) Nodes. The WSN nodes consume power due to their use in continuous monitoring and control applications. Therefore, to provide prolong network life time to WSN nodes photovoltaic energy harvesting may be used for battery charging. In this paper,buck, boost, buck-boost, Cuk and SEPIC converters are simulated in PSIM software and different currents and voltages waveforms have been analyzed. Secondly, their mathematical modeling equations have been simulated in MATLAB and graph has been plotted. From different graphs, the performance parameters have been evaluated for wireless sensor network nodes requirements. Our simulation results prove that the power efficiency of the boost converter reaches 85% and most suitable for WSNs.**

Keywords- **DC-DC Converters, Performance Analysis, Photovoltaic energy harvesting, Wireless Sensor Network Nodes**

I. INTRODUCTION

The conventional Wireless Sensor Networks (WSNs) has the design problem of high power consumption (in mWrange)during their continuous operation in monitoring and control applications. This design problem has been tackled by mainly duty cycle based approach till now. In this paper, we present an innovative idea of the solar energy harvesting which is a new design solution to the energy constrained WSN nodes. The solar photovoltaic (PV) energy harvesting refers to converting solar light energy into electrical energy to operate an electrical or electronic device. As applied to WSNs, the solar energy is converted into electrical energy and is utilised to operate a WSN node. The electrical energy harvested from solar energy (sunlight) can be used directly to power WSN node. Alternatively, the harvested energy can be stored in a rechargeable battery (or supercapacitors) for the future purpose (e.g. during night time when sunlight is not available).The solar energy harvesting wireless sensor networks (EHWSNs) consist of small autonomous wireless sensor nodes attached to small size solar panels for their energy harvesting needs. The EHWSN are used for monitoring and control applications of the environmentvariables such as light, temperature, Humidity, pressure and acceleration monitoring of any area/plant/process.

1.1 DC to DC converters: The DC-DC converter is a power electronic device, which is used to convert the voltage amplitude from one level to another level [1]. The

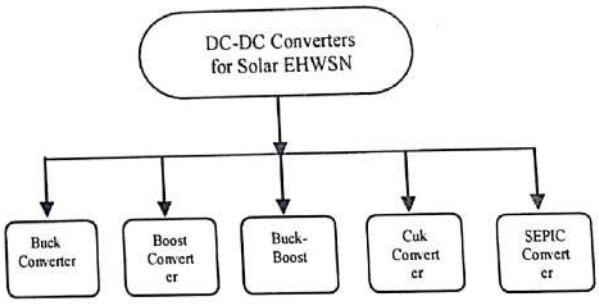


Fig.1 DC-DC converters for solar EHWSNs

voltage levels range from very low (mV) to high (volts) values. The main types of dc to dc converters topology are shown in fig.1 as:

- Boost Converter,
- Buck Converter,
- Buck-Boost converter
- Cuk Converter
- Single End Primary Inductor Current (SEPIC)

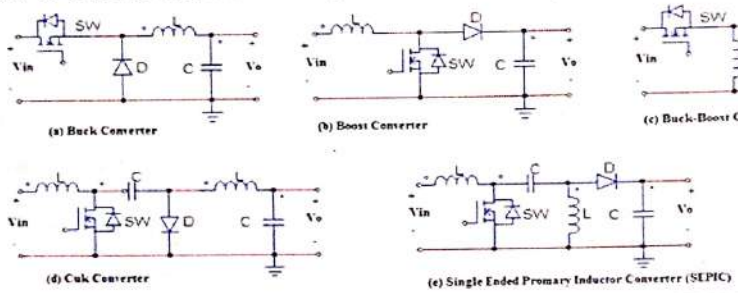
The boost converter increases the amplitude of harvested energy by using capacitors and inductor and a switch (MOSFET). The buck converter is used to decrease the amplitude of harvested energy if the excess amount of energy is received by the solar panel. The Buck-BoostConverter performs both actions of increase/decrease using the single common circuit. Generally, in photovoltaic applications, the boost converter is mostly used because the received power from the sun is very low (~mW). Some common topologies of DC-DC converters are shown in

Fig.1. The switches are practically implemented by using MOSFETs.

II. LITERATURE SURVEY ON DC-DC CONVERTERS

The major research issue in DC-DC converters is switching frequency, switching losses, resistive losses, Inductor selection, and capacitor selection. Chowdary G. and Chatterjee S. [2] have proposed a 300-nW sensitive, 50-nA DC-DC converter integrated circuit (IC) for solar energy harvesting applications. The circuit can harvest energy whenever the available power is greater than 0.3μW. The Efficiency (η) at 0.3 μW is 25%, at 0.5 μW is 37%, at 1 μW is 48% and at greater than 2 μW is 50%. Chowdary G. et al. [3] have presented an 18 nA, 87% efficient solar, vibration and RF Energy-harvesting power management system with a single shared inductor.

In this paper, they have proposed a modular MPPT based DC to DC buck-boost converter that can harvest from multiplesources over a range of available powers (from nW to μW) with one shared inductor.



Sr. No.	DC-DC converter Topology	Author	Year	Main points/ Equation	Numerical Results / DC-DC Converter Efficiency (η%)= (P_{out} / P_{in}) x100	Limitations	Our Comments
1	Boost Converter with MPPT	Chowdary G. and Chatterjee S. [2]	2015	Process : 0.18 μm, Output Voltage :1-2volts, Current consumption : 50nA, Startup Mechanism: External $P_{in(min.)}$: 0.3μW, Chip Area :1 mm x 0.2 mm	At 0.3μW η=26 %, At 2 μW η=52 %, At 10 μW η=76%	A bulky external Startup Inductor is used.	The startup circuit can be fabricated inside the chip also using Switched Capacitors (SC).
2	Boost converter with Open Circuit Voltage(OCV) type of MPPT.	Chowdary G. et al. [3]	2016	An oscillator is used instead of comparator, No current sensing used.	η = 87% at 20 μW input power	Current sensing is not used.	MPPT is obtained at small power levels
3	To remove large size inductor the switching capacitors (SC) are be used.	YifengQi u et al. [4]	2011	Process: 0.18μm CMOS. Startup Mechanism: Not reported, The DC-DC converter can boost 0.35V input to to 5.2V	Single voltage doubler η = 70%, end to end efficiency η = (P_{out} / P_{mp}) x100is 35%.	Operation is limited to the μW ranges.	Improved efficiency
4	A DC-DC converter with switched capacitor is presented	Wanyeon g Jung et al. [5]	2014	Process: 0.18μm CMOS. Startup Mechanism: Cold start,	voltage doubler η = 75%,	Cold start system	A Switch capacitor based DC-DC voltage doubler circuit, is used as boost converter
5	A minimum power consumption output voltage detector (OVD) is proposed	Qing Liu et al. [6]	2012	Process: 0.18μm CMOS, Startup Mechanism: Charge Pump based self-startup, Min Input Voltage: 30mV Output Voltage: 1.8V MPPT:Yes synchronous boost converter	Efficiencyη:84% @180μW	High Power Efficiency	idle power consumption is very small i.e. 1.9μW.
6	A regulated charge pump with MPPT algorithm	Jungmoon Kim et al. [7]	2011	Process: 0.35μm CMOS, Startup Mechanism: Charge Pump , Controller Power:850nW Min Input Voltage: 30mV Output Voltage: 2 V MPPT:Yes	End to End Efficiency η = 86 % @ 35 μW	Input voltage range is 1-2.7 volts	No current sensor required that consumes more power

YifengQiu et al. [4] have proposed a 5μW-to-10mW input power range inductive boost converter for indoor photovoltaic energy harvesting with integrated maximum power point tracking algorithm. Wanyeong Jung et al. [5] have proposed a 3nW fully integrated energy harvester based on Self-oscillating switched-capacitor, dc-dc converter for wireless sensor networks. Qing Liu et al. [6] have proposed an integrated circuit (IC) for a DC-DC boost converter for energy harvesting applications with 30-300mv input, ultra-low power and self-startup features. Jungmoon Kim et al. [7] have presented a regulated charge pump with a low-power integrated optimum power point tracking algorithm for indoor solar energy harvesting application.

III. DC-DC converter Performance Parameters:

Table 2 shows the mathematical equations of DC-DC converter performance parameters as [28]:

- Duty Cycle (D)
- Operating Frequency (f)
- Inductor ripple current (ΔI_L)
- Capacitor ripple voltage (ΔV_c)
- DC-DC conversion efficiency (η)
- Diode Conduction losses
- MOSFET Switching Losses
- Losses in storage devices (inductor and capacitor)
- Switching Stress on MOSFET
- Total power loss

Duty Cycle (D) Control of DC-DC Converters:
The DC-DC converter operation can be controlled by controlling the duty cycles of MOSFET switch. In constant duty cycle operation mode, the switching frequency is kept constant and only ON time (t_1) is varied. In variable duty Cycle Operation, either ON time (t_1) or OFF time (t_2) is kept constant and switching frequency is varied.

Operating Frequency (f):
At higher switching frequency the switching losses in the MOSFET increases. Thus overall efficiency (η) is decreased. At lower switching frequency, the value and size of capacitor and inductor is increased. Thus a tradeoff between size and efficiency is to be maintained.

Inductor Selection:
The critical value of inductor determines continuous or discontinuous mode of operation of DC-DC converter for a given duty cycle (D), frequency (f) and load resistor R_L. The critical value is the minimum value of the inductor (mH) below which the converter goes into discontinuous conduction mode.The critical values of inductor L_c is given as:

For Buck Converter:

$$L_c = L = \frac{(1-D)R}{2f} \quad ...(1)$$

For Boost Converter:

$$L_c = L = \frac{D(1-D)R}{2f} \quad ...(2)$$

For Buck-Boost Converter:

$$L_c = L = \frac{(1-D)R}{2f} \quad ...(3)$$

For Cuk Converter:

$$L_{c1} = L_1 = \frac{(1-D)^2R}{2Df} \quad ...(4)$$

$$L_{c2} = L_2 = \frac{(1-D)R}{2f} \quad ...(5)$$

Capacitor Selection:
The capacitor acts as a filter to the output voltage V_0. It has equivalent series resistance (ESR). The ESR value should be low to increase the efficiency.

For Buck Converter:

$$C_c = C = \frac{(1-D)}{16Lf^2} \quad ...(6)$$

For Boost Converter:

$$C_c = C = \frac{D}{2fR} \quad ...(7)$$

For Buck-Boost Converter:

$$C_c = C = \frac{D}{2fR} \quad ...(8)$$

For Cuk Converter:

$$C_{c1} = C_1 = \frac{D}{2fR} \quad ...(9)$$

$$C_{c2} = C_2 = \frac{D}{8fR}$$

...(10)

Table 2: Performance parameters of DC-DC Converters

Sr. No.	Performance Parameters	(a) Buck Converter	(b) Boost Converter	(c) Buck-Boost Converter	(d) Cuk Converter	(e) SEPIC Converter
1	Output Voltage (V_o)	$Vo = Vin.D$	$V_o = \frac{V_{in}}{(1-D)}$	$V_o = -\left(\frac{D}{1-D}\right)V_{in}$	$V_o = \left(\frac{D}{1-D}\right)V_{in}$	$V_o = \left(\frac{D}{1-D}\right)V_{in}$
2	Duty Cycle (D)	$D = \frac{V_o}{V_{in}}$	$D = 1 - \frac{V_{in}}{V_o}$	$D = \frac{V_{in}}{V_o}$	$D = \frac{V_o}{V_o - V_{in}}$	$D = \frac{V_o}{V_o + V_{in}}$
3	Inductor Ripple Current (ΔI_L)	$\Delta i_L = \frac{V_{in}\,D}{f.L}$	$\Delta i_L = \frac{V_{in}\,D}{f.L}$	$\Delta i_L = \frac{V_{in}\,D}{f.L}$	$\Delta i_{L1} = \frac{V_{in}\,D}{f.L_1}$ $\Delta i_{L2} = \frac{V_o\,D}{f.L_2}$	$\Delta i_{L1} = \frac{V_{in}\,D}{f\,L_1}$ $\Delta i_{L2} = \frac{V_o}{L_2}\left(\frac{D(1-D)}{D-1}\right)$
4	Capacitor Ripple Voltage (ΔV_c)	$\Delta V_c = \frac{i_o\,D}{f.C}$	$\Delta V_c = \frac{i_o\,D}{f.C}$	$\Delta V_c = \frac{i_o\,D}{f.C}$	$\Delta V_{c1} = \frac{i_{in}(1-D)}{f.C_1}$ $\Delta V_{c2} = \frac{V_{in}\,D}{f^2 C_2 L_2 D}$	$\Delta V_{c1} = \frac{i_{in}(1-D)}{f.C_1}$ $\Delta V_{c2} = \frac{(1-D)(i_{in}L_2 - V_{in}D)}{f.C_2L_2}$
5	Converter Efficiency(η)	P_0 / P_{in}	$P_0 / P_0 + P_{loss}$	P_0 / P_{in}	P_0 / P_{in}	P_0 / P_{in}
6	Diode Conduction losses	Medium.	Medium	Less	High	High
7	MOSFET Switching losses	Less	High	High	Medium	Less
8	Losses in Energy Storage elements (L&C)	Low at Lower Input Power Levels(Pi)	Medium	Medium	High	High
9	Switching stress on Semiconductor Elements	Low	Medium	Medium	High	High
10	Total Power Loss in DC-DC Converter	High	Low	Medium	Low	Low

IV. BUCK CONVERTER

In Buck converter, the average output voltage (Va) is less than the input voltage (Vin).

Operation: When MOSFET switch is closed at time t_1, the input voltage V_{in}appears across the load resistor R_L. if the MOSFET switch remains OFF for the time t_2 , then the voltage across the load resistor R_L is zero. The amplitude of output voltage V_0 is less than the input voltage V_{in}.

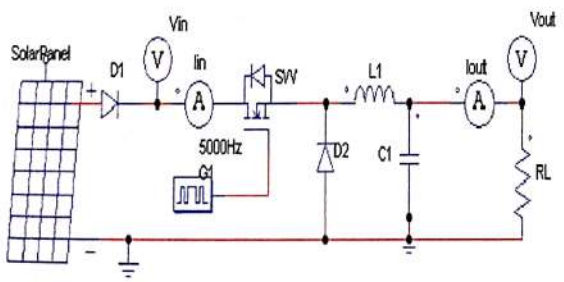


Fig.3 Buck Converter

Output Voltage: The average output voltage of buck converter is given by

$$V_{0_t} = \frac{1}{T}\int_0^{t_1} v_o\,dt = \frac{t_1}{T}V_{in} = f.t_1.V_{in} = V_{in}.D \qquad ...(11)$$

The average load current at output is given by

$$I_0 = I_L = V_0 / R = D.V_{in} / R \qquad ...(12)$$

Where, T = chopping period, D = t_1 / T is duty cycle, f = chopping frequency.

Table 3: Buck Converter Simulation Parameters:

Simulation Parameters	Value
Input Voltage ,Vin	1.5v dc
Output Voltage, Vo	0.8v dc

Capacitor, C_1	500uF, 5v
Inductor, L_1	500uH , 5v
MOSFET Switching Frequency(f)	50Hz
Load Resistor,R_L	20 ohm

Table4:Solar Panel Parameters:

Simulation Parameters	Value
No. of Cells in Series(N_s)	2 (0.8v each)
Max. Power ($P_{max.}$)	0.5 watts
Silicon material Energy Band Gap (Eg)	1.12 eV
Solar Panel (2 solar cells in series connection)	Voc=1.6 V, Isc=2 A, Vm=1.5 V, Im=1.8 A
Light Intensity	1000 watts/m^2 or 100 milli watts/cm^2
Temperature	25 Degree Celsius

Buck Converter Simulation Results:

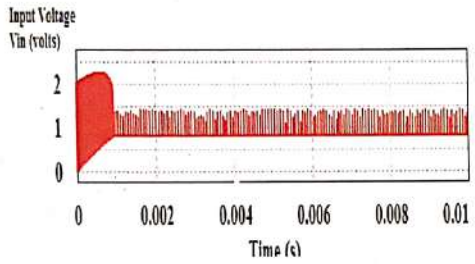


Fig. 4 Buck Converter Input Voltage from Solar Panel

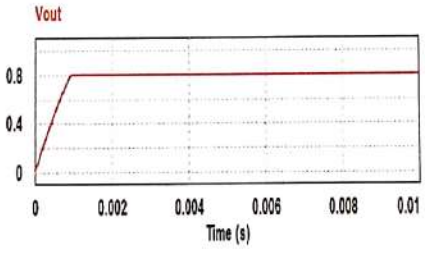


Fig.5 Buck Converter Output Voltage to the load

V. BOOST CONVERTER

A boost converter increases the DC input voltage and gives at the output.A boost converter circuit is shown in fig.2. It consists of an Inductor, a MOSFET switch, a PWM signal generator, a diode, a capacitor and a resistive load.

Operation: When switch is closed, the current rises through the inductor (L) and the MOSFET switch.

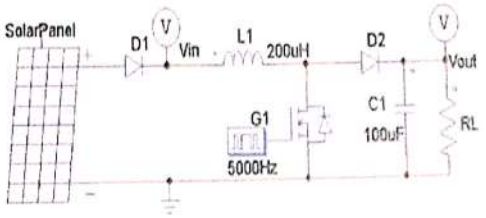


Fig.6 A 99% efficient 3 volts solar energy harvesting boost converter for WSN nodes

Table 5: Boost Converter Simulation parameters

Simulation Parameters	Value
Input Voltage ,Vin	1.5v dc(rippled)
Output Voltage, Vo	3.3v dc
Capacitor, C_1	100uF, 5v
Inductor, L_1	200uH , 5v
MOSFET Switching Frequency(f)	5KHz
Load Resistor,R_L	10 ohm

Boost Converter Simulation Results:

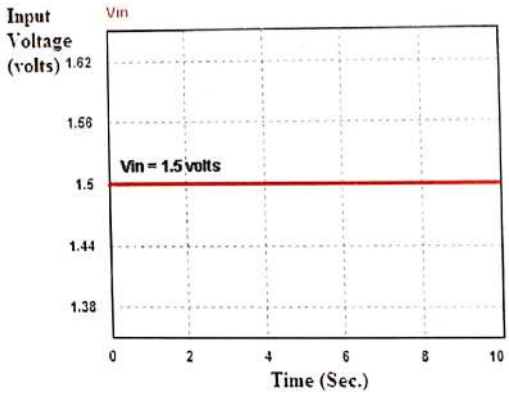


Fig.7 Input Voltage to the Boost Converter from Solar Panel

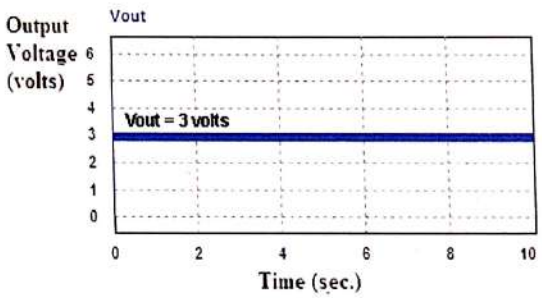


Fig.8 Output Voltage of Boost Converter to the load

VI. EFFICIENCY CALCULATIONS

The boost converter efficiency is defined as output power (P_0) divided by sum of output power (P_0) and losses. Here; Output power is calculated by the formula as

$$P_0 = \frac{D.(V_{in} - V_{sw})^2}{R} \quad \ldots (13)$$

Where, V_{sw} is Switching loss of converter, D is duty cycle, R is load resistance and V_{in} is input dc supply voltage from solar panel. In this experiment D=0.5, V_{in} = 1.5 volts dc, V_{sw} = 0.2 volts, and R = 10 ohms. So using equation 13 the input power calculated is approximately 65mW. Now the efficiency is calculated as

$$Efficiency\ (n) = \frac{P_0}{P_0 + P_{loss}} \quad \ldots (14)$$

Let, the power loss due to switching loss is 0.5mW. Then, boost converter efficiency (η) is 65mW/65.5mW= 99.23%.

7. Conclusion:

In this paper, the performance parameters of DC-DC converter have been analyzed. A boost converter simulation have also been performed in PSIM simulator. The input and output voltages have been plotted and shown for performance analysis. From the simulation it is observed that in DC-DC converters the desired output voltage can be obtained by proper selection of component values of Inductor, capacitor and switching frequency. The efficiency (η) of out desined boost converter is 99.23% which is very useful for solar energy harvesting wireless sensor network nodes.

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MORPHOLOGICAL SHARED-WEIGHT NEURAL NETWORKS IN FACE DETECTION

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ABSTRACT – This project proposes a classification-based face detection method using Gabor filter features. Considering the desirable characteristics of spatial locality and orientation selectivity's of the Gabor filter, the design filter is used for extracting facial features from the local image. The feature vector based on Gabor filters is used as the input of the classifier, which is a Feed Forward neural network (FFNN) on a reduced feature subspace learned by an approach simpler than principal component analysis (PCA). The effectiveness of the proposed method is demonstrated by the experimental results on testing a large number of images and the comparison with the state-of-the-art method. Here, the image is convolved with Gabor filters by multiplying the image by Gabor filters in frequency domain. The output matrix is reduced in size using MSNN (Morphological shared neural network).

Key words: ***Face Detection, Gabor Filter, Feed Forward Neural Network, Principal Component Analysis, Morphological shared neural network***

I. Introduction

Face detection and recognition has many applications in a variety of fields such as security system, videoconferencing and identification. Face classification is currently implemented in software. A hardware implementation allows us real-time processing, but has higher cost and time to-market. Therefore, the objective of this work is to implement a classifier based on neural networks (Multi-layer Perception) for face detection. The ANN is used to classify face and non-face patterns. The objective not only creates another system that is able to identify a query face image from a database, Most importantly, the delivered prototype maintains its robustness on face images of poorer quality using MSNN (Morphological Shared Neural Network).

The MSNN is a heterogeneous network composed of two cascaded sub-networks, the feature extraction and classification neural networks. The feature extraction layer takes a two dimensional array as input, which is the input sub-image. This input is passed through kernels that can perform a linear or non-linear mapping; these kernels are the morphological structuring elements. Each sub-image input to the network is passed through both the hit and miss kernels. These structuring elements together compose the input weights of the next layer, a feature map. The combination of structuring kernels and feature maps perform the gray-scale hit-miss transform, which is the output result for the feature extraction phase of the MSNN. This output is the direct input to a classic feed-forward neural network. The feature extraction and classification networks are trained together, allowing the MSNN to simultaneously learn feature extraction and classification for a face.

Besides variations in orientation, expression, and occlusion, the most concerned feature is the ability of the MSNN to perform well even under gray-level shifts. MSNN can recognize successfully under different shifts in light levels as well as handle other kinds of variations.

The certain physical requirements desired for the planning stage are:

(a) It should have a GUI through which the user can execute each task;
(b) The interface should be simple, clear, and systematic: one button, one function;
(c) It should allow the user to select the test image;

Further each subprogram should be straightforward and should not contain functions that overlap;

(a) it should display both the test image and the detected image at the end of the recognition process;
(b) it should display the training process for observation purposes;
(c) It should display recognition results so that we are able to evaluate and analyze.

The things that are considered next are the image processing tasks. Internally, all pattern recognition systems have the following processes.

1. Image acquisition
2. Image enhancement
3. Image segmentation
4. Feature extraction
5. Neural training and classification
6. Detection /Recognition

Since the output of each operation is the input to the next, the functional parts (1-6) must execute in sequence. For the MSNN, Task 4 and 5 and combined. The size of every image (input and output) is to be kept standard so that there is better control and accuracy during matrix computation and parameter training.

The classification FFN phase has a fuzzy output of the confidence that an input sub-image is the desired target face. To utilize this output, a Detection Image Plane (DIP- image black with gray and white pixels) is created and converted to gray-scale. A threshold is applied to this image, with the corresponding high values overlaid onto the input image. The result of this is an image with the target marked by white in the middle of the face (as seen below). Another output image is the

BOX image; this is accomplished by converting the DIP to a binary image at the threshold point and applying some post processing on this

generated image. The result is then used to construct a box the size of the scanning sub-image centered on the target.

II. Methodology

The block diagram of Methodology used in paper is represented in Fig 1.

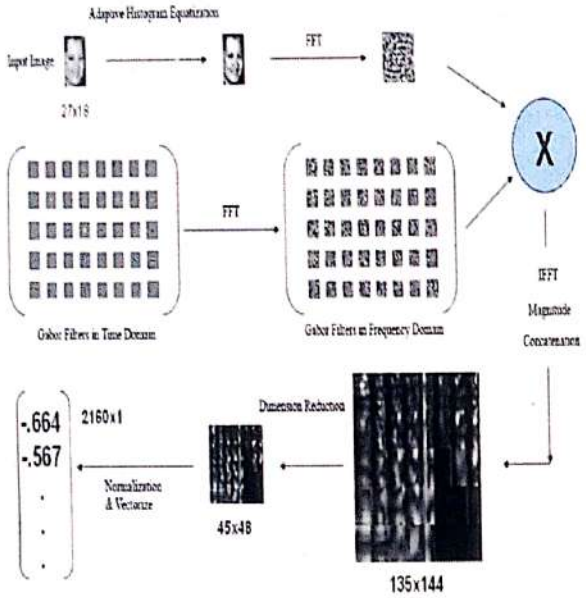


Fig. 1 Block Diagram

The three different sections used to execute the tasks illustrated above are given in Fig. 2 to 9.

FIRST SECTION:

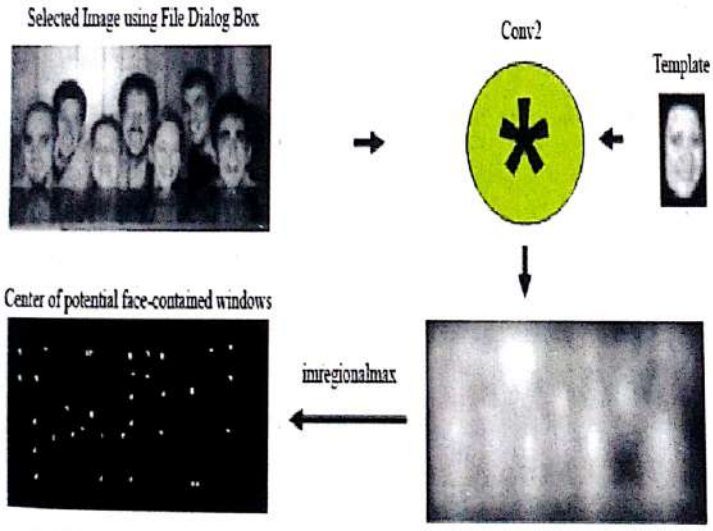


Fig. 2 Feature extraction and Convolution

SECOND SECTION:

In this section the algorithm will check all potential face-contained windows and the windows around them using neural network. The result will be the output of the neural network for checked regions.

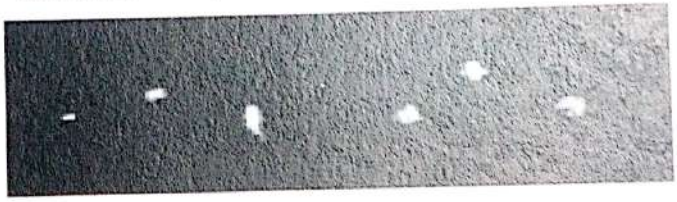


Fig. 3 Cell Net

THIRD SECTION:

Filtering & dilation is carried out taking threshold values in order to determine centers of faces & thereafter highlight faces accordingly.

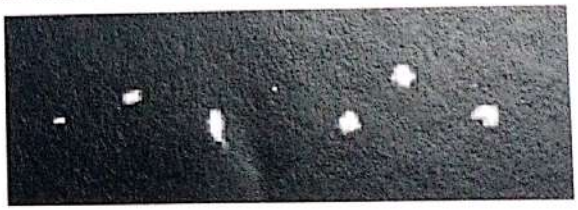


Fig. 4 Filtering above pattern for values above threshold (xy)

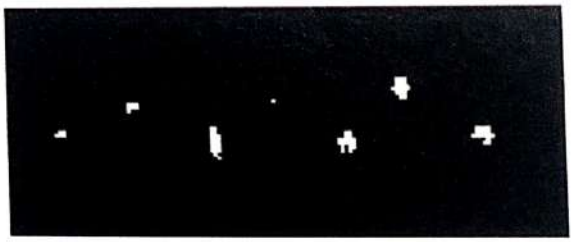


Fig.5: Dilating Pattern with a Disk Structure

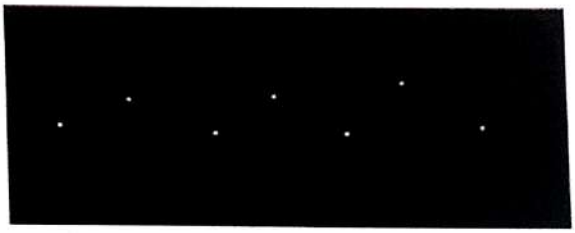


Fig.6: Finding Centers of each Region

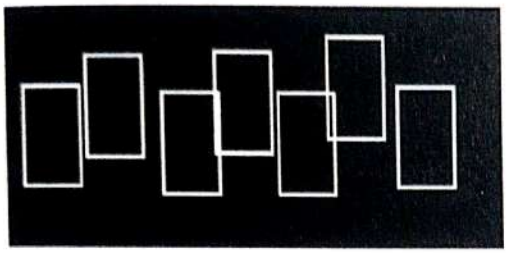


Fig. 7 Draw a Rectangle for each Point

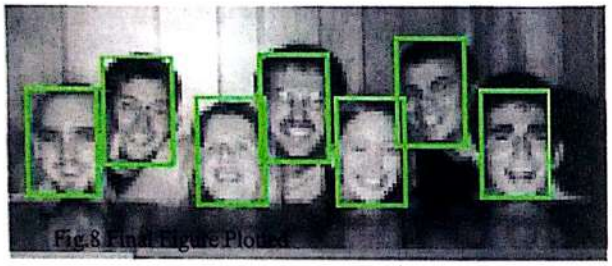


Fig.8 Final Figure Plotted

This architecture is implemented using MATLAB in a graphical environment allowing face detection in a database.

III. Simulation and Results

The MSNN model developed is largely dependent on two issues mainly. These are:

(a) Complexity: How large is our image database? How large should one image be? Should we make them smaller or larger by resizing?

(b)Performance and Reliability: We need to know which neural network is reliable and learns fast. In terms of classification quality, we have to know how these various networks perform their computations. Are these techniques suitable for training digital images?

The experiments were carried out for varying size and shape of the structuring element. The size was increased for structuring element and Results showed that the MSNN is not very sensitive to structuring element size and shape.

However, For the network that uses a "disk" structuring element, recognition accuracy remains constant at 100% until it drops abruptly at the size of 31×31 pixels; the fail size is 29×29 pixels for the network that uses a "diamond" structuring element. Fig. 10 and Fig. 11 show the simulated results on structuring element with two different shapes.

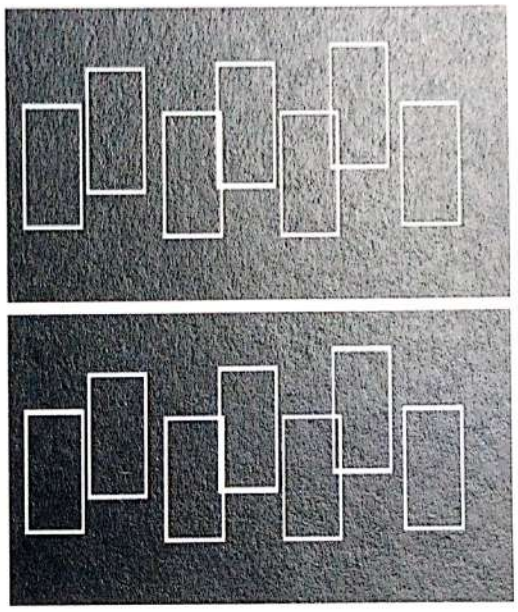
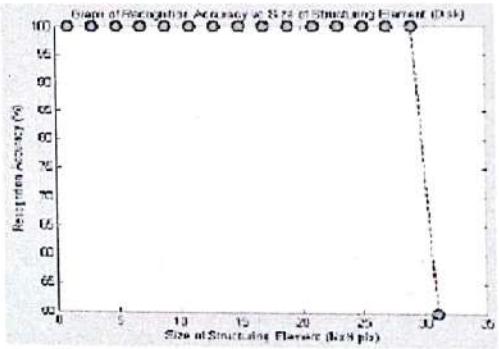


Fig. 10. Graph of recognition Accuracy vs. size of disk structure Element



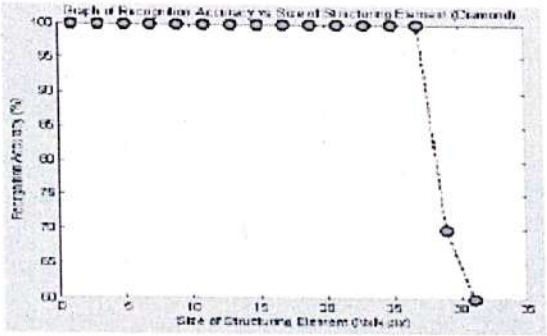


Fig. 11. Graph of recognition Accuracy vs. size of diamond structure Element

These findings indicate that the size of the structuring element must not get too close to the size of the input image. Since, the human face has a nonlinear pattern; hence, the "disk" structuring element should be used to perform hit-miss transform in the feature extraction stage. The performance of the MSNN is very sensitive to the proper setting of the learning rate. It cannot be set too high; otherwise, the network may oscillate and become unstable. Several Learning rates are to be plotted in further stages to show the morphological shared-weight neural work can approach the robustness needed for face recognition.

IV. Conclusion

A good feature set when used in simulation of face recognition and detection can make the training and decision- making simpler and more accurate. The strength of the MSNN is in its translation-invariant extraction layer. It enables the network to learn complex patterns by extracting progressively more meaningful features from the input patterns of a face. The MSNN avoids being too restricted by mathematical metric in its classification process. This increases its ability to generalize. The different structuring elements can be tested and verified for number of images for future researchers and scientists.

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Automatic Solar Powered Irrigation System Based Prototype titled 'Inno- Village'

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Abstract— **This paper focuses on the development of advanced irrigation model which will improve the quality of life and help in irrigation, green house effect, and solar powered electricity. Depleting fossil fuels and alarming environmental concerns have propelled the mankind to explore for non- conventional energy source such as solar energy, wind energy, among others. Since, countries like India receive direct sunlight through out the year therefore, this paper emphasizes on use of solar powered energy to solve the energy crisis. This project consists of a village model, Inno-village. Inno village or innovation village employs solar energy for solving energy problems of farmers. This model involves use of vivid advanced sensors and microcontroller for irrigation of fields, cultivation of green- house crops, control of moisture, and electricity for village, among others.**

Keywords— **Inno-Model, Solar Based Irrigation System, Automatic Irrigation System, Irrigation System Using Arduino Uno, IOT Based Irrigation System, Solar Panel, Moisture Sensor**

I. INTRODUCTION

According to World Bank Group, agricultural sector covered 60.4% of the India's land in 2015. Major share of people are involved in farming directly or indirectly and agriculture serves as one of the significant sectors in the country. There are four major types of crops that are cultivated in India such as food crops, cash crops, plantation crops and horticulture crops among others. Agricultural based countries required vast amount of water for their watering or irrigation. Irrigation may be defined as the science of artificial application of water to the land or soil that means depending on the soil type, plant are to be provided with water. Nowadays for irrigation different Techniques are available which is used to reduce the dependency of rain[1]. And mostly this technique is driven by electrical power and on/off scheduling controlled. Also, according to the survey conducted by the Bureau of Electrical Energy in India in 2011, there are around 18 million agricultural pump sets and around 0.5 million new connections per year are installed with average capacity 5HP. Total annual consumption in agriculture sector is 131.96 billion KWh (19% of total electricity consumption)[2]. When the countries from around the world are facing water crisis then, Irrigation through direct pump sets is highly inefficient and ultimately leads to wastage of water, therefore farmers have already devised other irrigation methods like drip irrigation, sprinkler irrigation, surface irrigation among others. Sprinkler irrigation being the preferred choice has several advantages including reduced leaching and less wastage of water. There are also some smart irrigation systems which makes use of microcontrollers and sensors to help in reducing consumption of water with suitable irrigation in real time applications. These advanced microcontroller based irrigation systems employ following techniques:

1. Utilization of different kinds of sensor nodes
2. Microcontroller for controlling the operations
3. Solar panel for solving the energy crisis
4. IOT based device for monitoring
5. Designed system can be used for watering introduced plants and plant pots

II. LITERATURE OVERVIEW

In this model various sensors are used in order to collect as much information as possible so that we can consider every factor from moisture, temperature to humidity making it practical for the varied environmental changes. ultrasonic sensor, humidity and temperature sensor, and moisture sensor are placed in the root zone of the plants or crop in the field while rain sensor is placed at a higher place from land. Various information are collected from these sensor nodes transmitting it to the microcontroller. Algorithm is designed in such a way that it allows water to flow into the field when any of these conditions satisfy:

1. if the water level in the pot or field is greater than 25cm
2. if all the moisture sensors in the field detect no moisture
3. if there is no rain detected by the rain sensor and there is moisture
4. if the value of the humidity and temperature is higher than a certain point in algorithm

In order to drive the motors for irrigation, photovoltaic panels are used to solve the energy demand.

This paper design a automatic irrigation system with the help of solar panel and sensors. Although, this model only controls the pump sets based on the information sent to the microcontroller by the nodes but it gives you detailed information about the soil in real time.

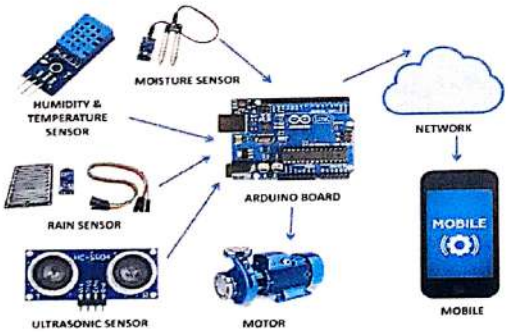

Fig. 1 Example of IOT based solar powered automatic irrigation system

III. The Proposed Work

Conventional irrigation systems consume large amount of water and particularly when water scarcity is such a notable issue we cannot afford to waste water. This model is a nascent approach towards minimizing the water usage by providing water only when the soil is dry. Sensors collect data and as a consequence of the collected information sent to microcontroller the pump set gets turned on or off. When there is sufficient amount of water in the soil as conveyed by the moisture sensors, the pump set is turned off by the microcontroller.[3] Since, irrigation is done only when it is required as a result preventing overflow and flooding of crop. Following are the major components that are used to for the proposed system:

1. arduino uno v3.0
2. diode
3. solar panel
4. LCD 20x4
5. ultrasonic sensor
6. humidity and temperature sensor
7. moisture sensor
8. rain sensor
9. relay
10. node MCU
11. relay
12. capacitor
13. motor

IV. System Description

Fig. 2 Different applications of Inno-Village

Inno–village is inspired by the Jawaharlal Nehru National Solar Mission and Digital India with the vision to create a model that has automated irrigation system, green house farming, solar street lights, internet-based farming. This project makes the use of clean renewable solar energy to drive the motor for irrigation. It has two modes automated mode and IOT based mode. It takes into consideration the environmental condition. Our project has a rain sensor, a moisture sensor, humidity and temperature sensor, ultrasonic sensors to consider all the factors of the environment. This automated project turns on pump set for irrigation in the field when ever there is low moisture in the soil, low humidity or high temperature in the surrounding. While when there are enough moisture and humidity or there is rain it

automatically turns off the motor. The leftover solar energy is stored in batteries to drive the household lightning or street lights. It can also be sold to the power plant to earn a profit. Since, we have taken into account the humidity, temperature and moisture. Therefore we can also use it for the green house farming which requires sensitive environmental conditions. All of the above-described model is automated so that farmers can engage themselves in other work. The best part of the project is IOT mode in which farmers can access the various parameters such as humidity, temperature, distance, moisture on the application of their smart phones. Blynk app uses the Internet to access data and we can control the fan and motor pump from across the world. Blynk app is available on the play store and can be downloaded for free and has easy customization option.

V. CONCLUSION

INNO VILLAGE helps to achieve the National Solar Mission by making automated, smart, digital, solar powered, self-sufficient, power generation model of the village. By using the automatic irrigation system we can optimizes the usage of water by reducing wastage and by minimizing the human intervention for farmers.The excess energy produced using solar panels can also be given to the grid with small modifications in the system circuit which can be a source of the revenue of the farmer, thus encouraging farming in India and at the same time giving a solution for energy crisis.[3] This model is reliable, cost efficient, and a long term advantageous approach with only one time investment.

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SMALL SCALE POWER GENERATION FOR RURAL HOUSEHOLDS

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Abtract: This paper includes details about a project to build a human powered generator with the help of a bicycle. This can be used for upto 120watts DC. This project will help to develop a clean way of generating electricity. It is intended to be both achievable and affordable.

Keywords: portable generator, clean electricity, low cost power generation

I. INTRODUCTION

The purpose of this project is to build a human powered generator with the help of a bicycle which is also portable and can be used to power small appliances such as dc fans, light bulbs etc. This project will help to develop a clean way of generating electricity. It is intended to be both achievable and affordable. By using principles of energy conversation a small amount of power source can be developed which can be used in rural and remote areas. The chemical energy in a person's body is converted into mechanical energy using a bicycle and then further into the electrical energy with the motor. This energy is stored in a battery for further use.

II. LITERATURE REVIEW

[10] A remote village has limited access to electrical power and, as a result, the village homes are lit with candles and kerosene lamps after dark. Narrow mountain paths limit the access to neighbouring villages and limits the supply of diesel for the village's generators. The task is to develop a small and sustainable source of electricity for the village. [7] The intention is to create a system that can be used to generate and store enough energy to light an LED or any other small appliance for about 10

minutes.It is intended to be both achievable and affordable. [1] The chemical energy in a person's body is converted into mechanical energy with the use of bicycle and then further into the electrical energy with the motor. By hand-cranking the bicycle pedal at different speeds we will discover that at higher speeds the lamp will get brighter. We shall also discover that the sound emitted by the speaker gets higher in .frequency and amplitude (volume) as the pedaling speed is increased. If the speaker or lamp has weak output, we will connect one at a time. An oscilloscope can also be connected to the dynamo to show the sinusoidal waveform. The loads provided should be appropriately matched to the dynamo's output. This energy can be measured by using a microcontroller and LCD display to display instantaneous power.

III. PROPOSED ARCHITECTURE

The various components which are required to build this project are mentioned below [2] A bicycle which can be of any size, the dynamo will be fixed at the hub of its rear wheel, Dynamo, bridge rectifier, voltage regulator and a LED bulb. [8] Its working can be explained as follows. The AC from the dynamo(present at the hub of the rear wheel) passes through a full-wave rectifier and feeds the LED bulb through the connected circuit elements. The current in the LED is limited by the dynamo to about 0.5Amps - 0.6Amps.LED should be capable of handling this much amount of current without getting fuse. [6] The charge (q) stored in a capacitor is the product of its capacitance (C) value and the voltage (V) applied to it. Capacitors offer infinite reactance to zero frequency so they are used for blocking DC components or bypassing the AC signals. The capacitor undergoes through a recursive cycle of charging and discharging in AC circuits where the voltage and current across it depends on the RC time constant. For this reason, capacitors are used for smoothing power supply variations. The instantaneous voltage produced by pedaling at normal speed is about 14 volts when measured through a multi meter. The light flickers when pedaling is done at low speed. Hence a smoothing capacitor is used to reduce the flicker at low speed and also to increase a little bit of brightness. Capacitor C1 used has a high value so as to reduce the flickering caused at low speed. A small value of capacitor C1will increase the flickering at low speeds. The capacitor should withstand at least 4V.Its value is limited by the size & its cost hence these factors should be kept in mind while choosing a capacitor. LED should be disconnected from the circuit after the capacitor has charged to its full value otherwise it can charge to a higher voltage level. This could be dangerous to the operator as well as for the LED. A sudden very high peak current will most likely destroy the LED or change its color. [9] By revolving the bicycle pedal at different speeds, we will find that at higher speeds the lamp will get brighter. We will also discover that the sound emitted by the speaker will be higher in frequency and amplitude. If the output of the speaker or lamp is weak, we will connect one at a time. An oscilloscope can also be connected to the dynamo to show the output sinusoidal waveform. **7805** is a **voltage regulator** integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The **voltage regulator IC** maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

IV. WORKING METHODOLOGY

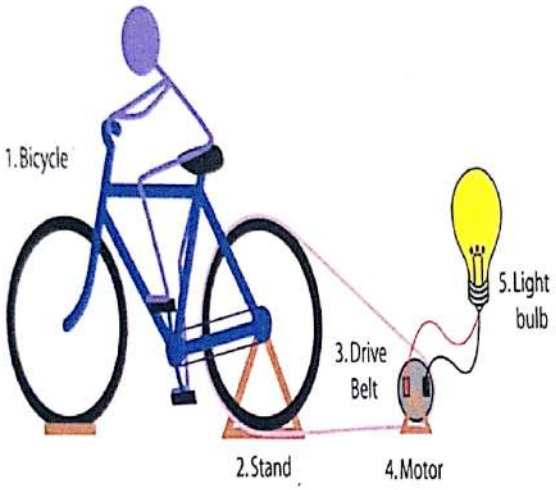

Figure1: Block diagram of small power generation.

A PMDC motor which is used as a generator is fixed at the hub of the rear wheel of the cycle.It is then connected to any dc appliance to which it gives power.[5] The generated electrical power could be used to charge a battery and could be stored or could be used to directly power appliances.The instantaneous voltage developed is around 14 volts which can be checked with the help of a multimeter. We could design an energy storage device that can be hooked up to the bicycle and is portable. It should be easily removable, compact, durable and capable of illuminating the LED via a current limiting resistor for at least 10 minutes.

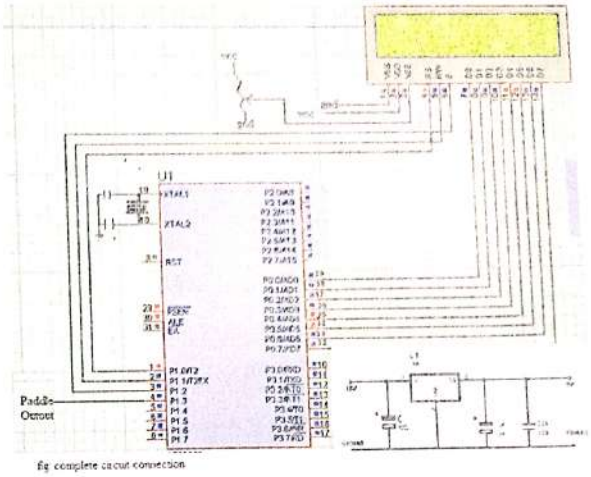

fig complete circuit connection

This energy can be measured by using a microcontroller and LCD display to display instantaneous power. The chemical energy in a person's body is converted into mechanical energy with the use of bicycle and then further into the electrical energy with the motor. This electrical energy is stored in a battery which can be used to drive LED light and some other small appliances. If we want to use AC power than a inverter can also be used with this apparatus. VCO is used for constant output voltage. In this project we are using 7805 voltage regulator which has an output of 5V.For an average adult cycling at a normal rate it would take around 1 hour to store approximately 150W of power .Several cycle generators can be connected in parallel and connected to a battery which can store power or to an appliance which consumes more amount of power.More the cycling speed more is the instantaneous power developed.But a smoothing capacitor is to connected in the circuit which removes the ripples or the spikes from the voltage or current waveform produced.This can also be used to power AC appliance by connecting an inverter in intermediate stages.The PMDC motor selected should

be according to the needs i.e for high power high rating and more rpm motor should be used.The total energy loss in a cycle generator will be around 42 to 67.5 percent (calculation example for highest loss: 100 watt input = 80 watt after 20% loss in motor/generator = 57.5 watts after 25% energy loss in voltage regulator = 37.5 watts after 35% loss in battery = 32.5 watts after 15% loss in converter = 32.5 watts output = efficiency of 32.5% or energy loss of 67.5%).

V. CONCLUSION

This project will help one develop engineering skills while learning about a clean way of generating electricity. This project is affordable as the total cost is around 1000 /-Rs only. By revolving the flywheel at normal speed the instantaneous power generated is around 80 watts. At high speeds it may go upto 110-120 watts. This setup can be installed on a bicycle. Therefore the user did not need to do extra efforts to charge this battery. As in rural areas and remote areas people mostly use a bicycle to go from one place to the other, so they can charge these batteries during their journies to their fields. This will reduce the efforts. We can light a LED of around 15 watts and a small DC fan around 2 hours with a fully charged battery of 12 volts. Project is easy to understand and develope as it is made basically for rural area purposes.

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SONAR Image Classifier using Discrete Wavelet Transform and Support Vector Machine

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***Abstract*—Accurate classification of seabed or riverbed is important in many more applications like dradging, study of marine biology, coastal engineering, hydrography etc. Numerous methods have already been proposed for seabed classification. In this paper, we presented a method to classify a given side scan SONAR images depending on type of sediment such as sand, mud, rock etc.In this study, we first employed discrete wavelet transform for extracting the features from side scan sonar images followed by applying principal component analysis (PCA) to reduce the dimensions of features. These reduced features then applied to support vector machine (SVM) for classification. We evaluated our proposed methodswith four different kernels as linear, quadratic, polynomial, GRB and found that the GRB kernel achieves the highest classification accuracy as 99.67%. The result shows that DWT+PCA+SVM achieve best accurate classification results.**

Keywords*—SONAR, Side Scan SONAR, discrete wavelet transform, principal component analysis, support vector machine.

I. INTRODUCTION

In most of the applications it is also important to know sediment composition of bottom.Over a few decades ago, hydrographer uses measurement methods like chronometers,sextant fixes and lead lines for seabed classification. Basically acoustic systems were designed and developed for measurements of ocean depths and also for obstacle detection. These acoustics systems were called as SONAR (Sound Navigation and Ranging). SONAR is an active system, which is capable of emitting and recording of the acoustic signal[1]. These systems are more accurate and there are three types are available such as, single beam echo sounder (SBES), side scan SONAR (SSS) and the multi-beam echo sounder (MBES).

In this study, side scan SONAR image database is used to determine the texture type of seabed.Side-scan sonar uses a device that emits conical or fan-shaped pulses down toward the seafloor across a wide angle perpendicular to the path of the sensor through the water, which may be towed from a surface vessel. The intensity of the acoustic reflections from the seafloor of this fan-shaped beam is recorded in a series of cross-track slices. Together along the direction of motion, these slices form an image of the sea bottom within the swath (coverage width) of the beam. The sound frequencies used in side-scan sonar usually range from 100 to 500 kHz, higher frequencies gives better resolution but less range. SONAR image analysis is carried out with texture analysis techniques due to highly textured form of sonar images [2].This is an active area in the fields of computer vision and pattern recognition and has many potential applications. In sonar images tone corresponds to amount of energy backscattered by each point in the image and gray levels express it. Textural properties correspond to the spatial organizationof the gray levels within neighborhood.Acoustic techniques can potentially provide efficientand cost effective underwater domain awareness for the planning of long-term utilization in irrigation, power generation, industry, and urban power supply and flood moderation[1]. Thus, higher research efforts are required to meet the challenges. This paper will be helpful in thestudy of underwater geology, detection of underwater mines, oil and gas exploration. Automatic recognition and classification of sonar images regarding seabed types are among the key issues.

The paper is organized into 4 sections. First section is introduction describing need for sediment classification and basics of Sidescan Sonar. Section two describes proposed methodology for sediment classification. Thirdsection reports the results of algorithm implemented. Final section is a concluding remark on project work.

II. METHODOLOGY

Wavelet transform allows analysis of images at variouslevels of resolution due to its multi-resolution analytic property so this is an effective tool for feature extraction from images. But this technique requires large storage capacity and computationally expensive.In order to reduce the feature vector dimensions, the principal component analysis (PCA) was used. To classify input data, there are two categories available one is supervised classification and other is unsupervised classification.Among supervised classification methods, the SVM is a classification methods based on machine learning theory [3].SVMs have significant advantagesof high accuracy, elegant mathematical tractability, and directgeometric interpretation as compared with ANN, decision tree and Bayesian network. Besides, it does not need a large number of training samples to avoid over fitting. This method is divided into three stages as preprocessing (includes feature extraction and reduction), training SVM, apply new

sonar image to trained SVM and predict the output. Figure (1) shows the methodology of proposed algorithm. Preprocessing step involves feature extraction and feature reduction process.

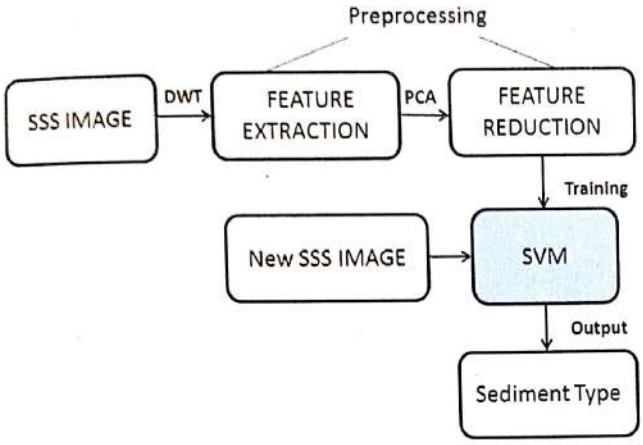


Figure 1- Schematic block diagram for sediment classification

- ***Feature extraction***

Wavelet Transform (WT) is a windowing technique with variable window size and this will be helpful to preserve both time and frequency information of the signal. Another advantage of WT is that, it adopts 'time scale' view of the data instead of 'time frequency'[4]. The discrete wavelet transform (DWT) is a powerful implementation ofthe WT using the dyadic scales and positions. The fundamentals of DWT is that, suppose x(t) is a square integral function then the continuous WT of x(t) relative to a given wavelet$\varphi(t)$ is defined as-

$$W\varphi(a,b) = \int_{-\infty}^{\infty} x(t)\, \varphi_{a,b}\,(t)dt.$$

Where,

$$\varphi_{(a,b)}(t) = \frac{1}{\sqrt{a}}\, \varphi \frac{(t-a)}{b}$$

Here, the wavelet $\varphi_{(a,b)}(t)$ is calculated from the mother wavelet $\varphi(t)$ by translation and dilation,a is the dilation factor and b the translation parameter (both real positive numbers). In this study, Harr wavelet is used for wavelet analysis, which is the simplest one and often the preferredwavelet in a lot of applications. Above equation discretized by restraining a and b to a discretelattice ($a = 2^b \& a > 0$) to give the DWT, which can be expressed as follows.

$$ca_{(j,k)}(n) = DS\left[\sum_n x(n) g_j^*(n - 2^j k)\right]$$

and

$$cd_{(j,k)}(n) = DS\left[\sum_n x(n) h_j^*(n - 2^j k)\right]$$

$ca_{(j,k)}$ *and* $cd_{(j,k)}$ represents coefficients of approximation and detail components , g(n) & h(n) represents LPF and HPF respectively, j and k denotes wavelet scale and translation factor respectively. DS operator means down sampling.

- ***Feature Reduction***

DWT generates excessive feature set which will increase computation times and storage memory. This will make classification more complicated so it is required to reduce the number of features. To reduce the dimension of a data set PCA is effective tool which consist of a large number of interrelated variables while retaining most of the variations. It is achieved by transforming the data set to a new set of ordered variables according to their variances or importance.

- ***Classification***

Classifiers are broadly classified into two categories as: Supervised including SVM and KNN and unsupervised classifiers includes self-organization feature map (SOFM) and fuzzy *c*-means. In this paper supervised classifiers are used because it performs better in terms of classification accuracy (success classification rate) as compared with unsupervised classifier [5]. The goal of this paper is to find more accurate method for sediment classification. Also in this paper we introduced kernel SVM (KSVM) which extends linear SVMsnonlinear SVM classifiers by applying the kernel function to replacethe dot product form in the original SVMs.

III. RESULTS

- ***Database Description***

This project work uses The Edge Tech DF1000 side scan sonar image data, a part of projectREBENT, IFREMER (Location: France).This database contains 240 images of six classes of sediment textures namely Mud, Sandy Mud, Gravely Sand, Clearly Sand, Rock, Mixed Sediment. Figure 2 shows sample images for each class from database. This database was used to survey coastal benthic habitats and evaluate biodiversity changes in a 200 km sq. Area in the Bay of Concarneau on the South Brittany, France.

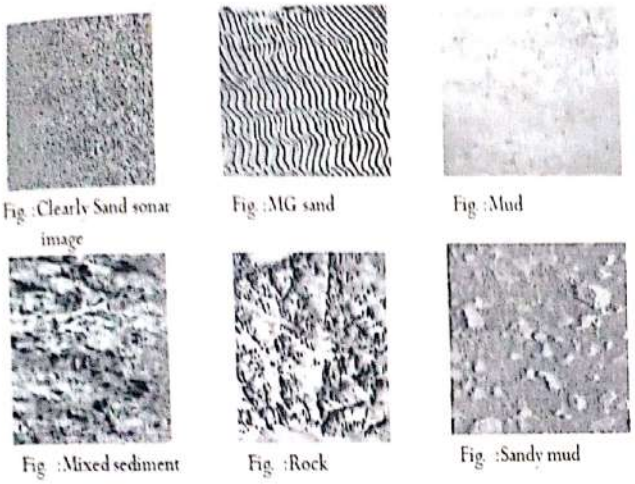
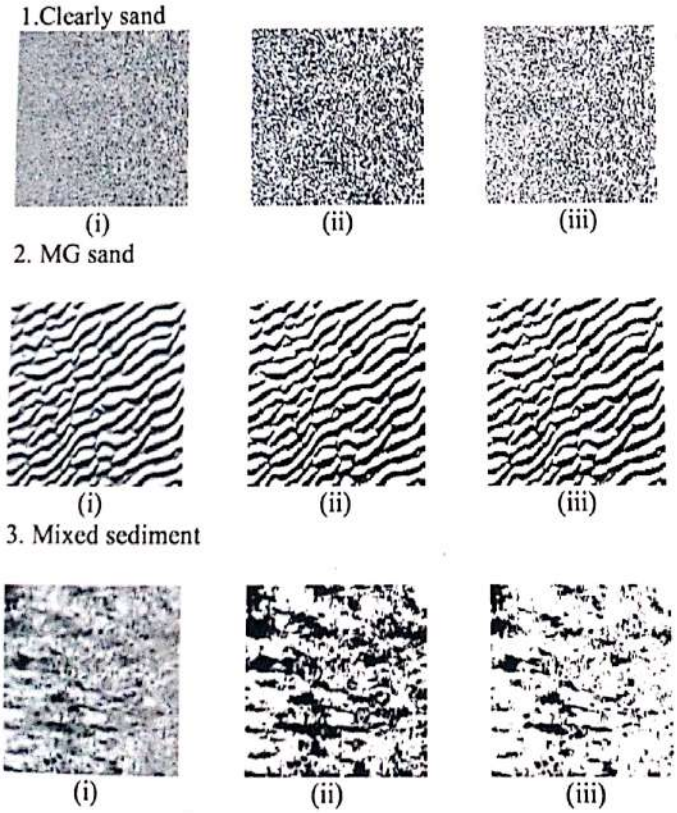
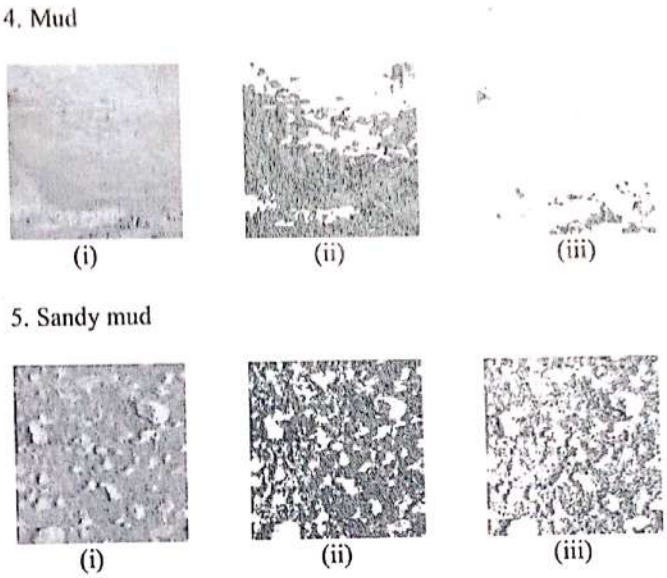


Figure 2- Sample SONAR Images from each class

- ***Feature Extraction***

In this study, features extracted from side scan sonar images using DWT and feature set is reduced to minimize the computational efforts using PCA. The reduced feature set consists of 13 features as: Contrast,Correlation,Energy, Homogeneity, Mean, Standard Deviation, Entropy, RMS, Variance, Smoothness, Kurtosis, Skewness, IDM.Suppose a test image from one of the six classes is taken and passed through DWT+PCA algorithm then following figures shows simulated results for all sediment types (i)Original SSS image, (ii) Threshold Image,(iii) Segmented Image.





IV. CONCLUSION

Given the textural features, an application to sonar texture classification is addressed, i.e. anunknown texture sample is assigned to one of a set of known texture classes using a SVM classifier.In this study, SVM classifier classify image correctly amongst six different classes. Using DWT+PCA+SVM classifier with Linear, Polynomial and GRB kernel function. From observed results we conclude that, polynomial kernel function shows worst accuracy for all sediment types, whereas linear kernel performs better but shows lower accuracy for mixed sediment types. But with GRB kernel function we got average accuracy of sediment classification is 99.67percent. From the wholeFeature vector applied to the classier, 75 percent is for Training and 25 percent for testing.

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AUTOMATED SMART SHOPPING CART

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Abstract- **An innovatory product with user acceptance providing with serenity, convenience , timelines and efficiency in day-to-day life. Shopping at malls is becoming daily activity most of cities. Malls are getting almost crowded now days, most of people do shopping from mall. People purchase different items and put them in trolley. After purchasing, one needs to go to billing counter for payments. At billing counter the cashier prepare the bill using QR Code Reader which is very time consuming process and results in long queue at billing counter.**

Keywords- **Smart Trolley, QR Code, Smart Shopping.**

I. INTRODUCTION

The idea for the project is to optimise this process of shopping at a retail store, by enabling the customer to handle the check-out process. The approach to automated shopping and billing until now has been more hardware-centric. A number of attempts have been made to design Smart Shopping Carts with various different functionalities . After negotiating busy supermarket aisles, you often have to pick the queue you think will move fastest to stand a chance of getting your shopping home before the ice cream melts. Now days purchasing and shopping at big malls is becoming a daily activity in metro cities. We can see huge rush at malls on holidays and weekends. The rush is even more when there are special offers and discount. People purchase different items and put them in trolley. After total shopping everyone requires to go to top billing counter for payments. At the billing counter the cashier prepare the bill using bar code reader which is a time consuming process and results in long queues at shopping centres . But this monotonous service may become a thing of the past thanks to sensors embedded into the wheel of trolleys. Our aim is to develop a system that can be used in shopping centres to solve the overlooking challenge. The system will be placed in all the trolleys. It will consist of a QRCode reader. All the products in the mall will be equipped with QR-Codes. When a customer place any products in the cart, its code will be recognised and the price of those products will be stored. Thus the billing will be done in the trolley itself. Item name and its cost will be displayed on local display. In the modern world, every supermarket employ shopping baskets and shopping trolleys in order to aid customers to select and store the products which they intend to purchase. The customers have to put every product which they want to shop into the shopping trolly and then move to checkout at the billing counter. The billing process is quite highly time consuming. We propose to do this by using a smart phone application that allows the user to scan the products he or she wishes to purchase, generate the bill for all the products selected, and make the payment. Instead of using traditional bar codes, we propose to use Quick Response (QR) codes to identify each product. The application includes an option to search where a product is located in the store. The entire process of bill generation is automatically carried out, and is displayed on the interface as the user continues shopping. Once all the items are scanned and the user confirms the purchase order, the final bill is generated and the user is be redirected to payment options. The customer has the option to sign up for a custom wallet that can be used for faster payment.

II. LITERATURE SURVEY

We believe that the current system of shopping at a retail store has seen little change and our proposed model can help enhance the customer shopping experience. Customers have to wait for painfully long

durations during the checkout process, irrespective of the number of items they are checking out of the shop. This is especially true when the people in front of you are counting their cash or coupons at an unbelievably slow pace and during discount sales. The billing process at a shop is the most tedious part of shopping, and we believe this can be eliminated. Also, when you are in a large store for the first time, finding a specific product can be a tedious task.

Moreover, retail stores traditionally make use of barcodes to identify each product as well as in their membership cards. In terms of data storage, bar codes can hold less data, mostly numeric, and take up greater space as they are one dimensional. Also, if a bar code is damaged or dirty, they are not capable of reading any data and they cannot be properly scanned.

We believe that the entire system can be changed to provide a better shopping experience for the customer, as well as for the store management, through digital solutions.

III. RELATED WORK

While doing survey we found that most of the people prefer to leave the shopping mall instead of waiting in long queues to buy a few products. People find it difficult to locate the product they wanted to buy, after selecting product they need to stand in a long queue for billing and payment. To try to resolve the problems formerly found, recent years have seen the appearance of several technological solutions for hypermarket assistance. All such solutions share the same objectives: save consumer's time and money, help the retailers to win loyal clients.

One system is designed i.e. the Web shopping cart system as a common client-server application on Web. Then they simplified several problems on implementation of Web shopping cart system, which are unfamiliar to the Web. In order to solve the problems, proposed a new mechanism that can manage user sessions with high reliability and safety. It is compared the Web shopping cart system implemented using the proposed mechanism with the one developed by the conventional methods.

One more system is proposed, an automatic embedded software generation framework that can create and evolve Zigbee applications. The framework consists of two major modules, pattern extraction and code generation. Pattern extraction and development are designed to provide Zigbee application with model reuse and modification. SysML serves as a medium between pattern development and code generation. A smart shopping cart application is implemented using this pattern based software framework.

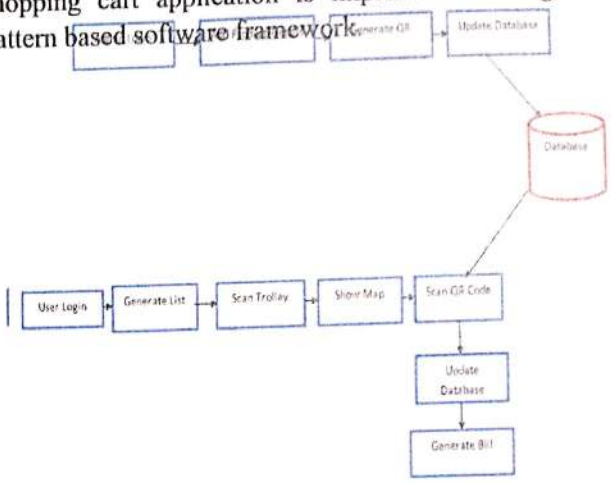

Fig1. Architecture Diagram of the System

The smart cart system combine a Shopping trolley(cart) with 2 sets of QR code scanners placed at 2 different location i.e. entry and exit respectively. It facilitates the user to self-scan the QR code of the purchased products which he intends to purchase. Wrong entries can be corrected by making use of a keypad that changes the working of the machine from adding the products to removal of products and activates the other QR code scanner at the opposite end. A wireless smart-device makes entry of all the scanned items of the particular cart (with allotment number) ; and is connected with the shopping centers backend database which contains details of the products such as Available Stock,Cost Price. The scanned items are automatically invoiced in wireless smart device for their purchases, thereby remarkably decreasing turnaround time and reducing and transmitted to the Shop's central Billing program. System will generate a bill. Then user will pay the bill and take out all their products and place them into carry bags during the checkout process.The smart phone application is one that provides a User Interface (UI) to interact with the products, by means of adding, viewing or removing it to a personalised cart. The customer can access the smart phone application for shopping once they have been authenticated via Bluetooth. The application uses a QR code scanning feature that accesses their

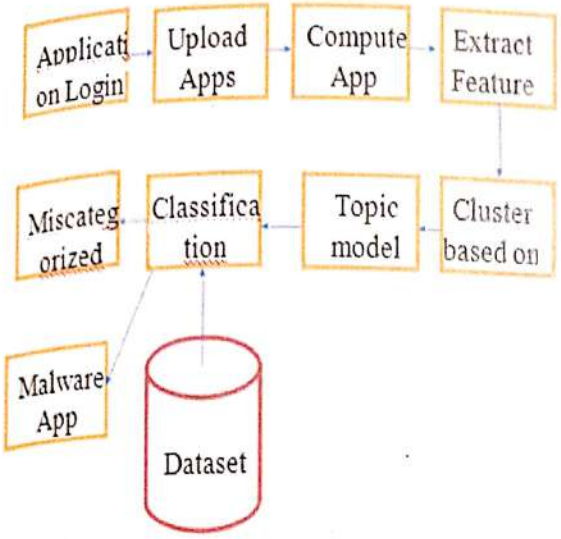

Fig2. Database Connectivity

smartphone camera and allows a user to pick up a product, scan its QR code and thereby add it to the cart. The UI display updates with the current product's details and the total bill auto-increments. The UI also has the option to select an item and remove it from the cart. The application is also able to tell the users which section of the store a particular product can be found in. This enables the user to quickly find what he or she is looking for and bypasses the hassle of standing in long queues to get their items checked out. In addition to this, there is also an option to pay using wallet for registered members. Once they log in, if their balance is sufficient, the bill amount is deducted from their wallet; else they are redirected to other payment options.

IV. CONCLUSION AND FUTURE WORK

We believe that this process of shopping can revolutionize the existing shopping system, as it isn't a very high cost investment for the store management. Almost everybody owns a smart-phone with a camera which is all that is required to perform the software automation that we propose. In exchange, the speed of shopping and the convenience that the customer gets is immense. This leads to a win-win situation where the customer is happy to come back for the convenience that this system provides, and the management is happy with the customer retention they get. In future we can also add weight sensors to detect weight of products added into the cart, and we can also use dynamo to the wheels of the cart to recharge the system.

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