Suryavardhan INTEGRATIONS
GSTN :37ACTFS3110Q1ZG
IEC CODE: 2615901346
AN ISO 9001-2008 CERTIFIED COMPANY
Design & Development of Electronic Projects, PCB Design
Mfg: Domestic & Industrial LED Lighting, AC LED Street Lights, Solar LED Street Lights

Dt: 05.04.2021

To,

The Principal,

Avanthi Institute of Engineering and Technology,

Makavarapalem, Andhra Pradesh.

Attention: Dr. T Srinivasa Rao, Professor and HOD of Department of Electrical & Electronics Engineering

Subject: Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications – Regarding

I am pleased to inform you that the R&D Team at M/s Suryavardhan Industries Ltd.,Visakhapatnam is pleased to approve a grant of INR 5 Lakhs for the project "***Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications***".

You are requested to prepare a detailed schedule and roadmap for the project completion and also the detailing on the utilization of funds within 15 days to release the payment.

Looking forward to a meaningful collaboration with AIET, Makavarapalem.

Regards,

Seshu Kumar Petla

(Managing Partner)

Suryavardhan integrations

3-188/2, Saradanagar, NARSIPATNAM,Visakhapatnam District, ANDHRA PRADESH - 531 116, INDIA.
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AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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(Approved by AICTE, Permanently Affiliated to JNT University, Kakinada, ACCREDITED BY NAAC and Recognised under 2 (f) & 12(b) by UGC, New Delhi.)

Tamaram, Makavarapalem, Narsipatnam Revenue Division, Visakhapatnam Dist. - 531 113.
Administrative Office : 51-8-40/21/2, Beside Rythu Bazar, Nakkavanipalem, Visakhapatnam - 530 013 (A.P.). Ph : 0891-2748231, 9652012340
e-mail : principal_aiet@yahoo.com Webside : www.avanthi.edu.in

Dr. C.P.V.N.J.Mohan Rao, M.Tech., Ph.D.
Principal

Dt: 20.04.2021

AIETM/03/2021/EEE/PROJECT/01

To,

The Surya Vardhan Integrations,

Narsipatnam

Visakhapatnam

Sub: Submission of detailed proposal of Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications.

Respected Sir,

With reference to letter received from your end regarding ***Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications***. We are happy to submit detailed proposal along with the milestones of Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications. We request you to discuss with your internal R & D team and communicate for further discussion.

Thank you and looking forward for your collaboration.

Principle Investigator

Head of the Department
Department of Electrical & Electronics Engg.
Avanthi Institute of Engg & Tech.
Makavarapalem, Visakhapatnam - 531113.

PRINCIPAL
Principal
Avanthi Institute of Engg. & Technology
Tamaram, Makavarapalem Mdl.,
Visakhapatnam District, Pin-531113

Committed for achieving Excellence in Technical Education

Section A: General Information

Project Title	**Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications**
Project Type *Research/Design & Demonstration of control of Electrical vehicle Research/Other*	***Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications***
Project Location/s *(District/State)(Must be in India)*	AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, Tamaram (V), Makavarapalem (M), Visakhapatnam-531113
Stage of development *(initial concept/proof of concept/ demonstration/scale up)*	Proof of concept - Demonstration
Lead Implementing Organization	AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, Tamaram(V), Makavarapalem (M), Visakhapatnam-531113
Any Partnering Organization:	-NO-
In INDIA	
(I) Total Funding Request *(INR In lakh)*	***Rs/-* 5,25,000.00**
(II) Contribution in Cash /kind from lead/partneringinstitution ,if any	-NO-
Total cost (I + II) =	***Rs/-*5,25,000.00**

Section B: Project Information: Report submitted

Project Description:

DC machines were widely used for variable speed applications a long time ago because of their simple controller and fast response, unlike any other machine. Whereas AC induction machines were used in constant speed applications when they are operated at constant input voltage and supply frequency. In recent years, large developments have taken place in variable speed drives for AC induction machines, because of wide developments in power electronics technology and power semiconductor devices, which lead to replacing the DC machine with an AC induction machine for major variable speed applications. This is due to many advantages of using AC induction machines over DC machines like lower cost, lightweight (20% to 40% lighter than an equivalent DC machine), rugged construction provides to operate the AC induction machine in harsh environments like dirt and moist environments. Like DC machines, an AC induction machine does not have a commutator and brushes problems. Now these AC drives are widely used in many industrial and domestic applications [1], [3], [4]. There are many ways of controlling the speed of an AC induction machine in industrial applications and one of the popular methods of controlling the speed is the constant V/F ratio, in this method the speed is controlled by varying the input voltage and frequency of the three-phase supply using an inverter with pulse width modulation (PWM) technique. In this proposed paper the speed of the AC induction motor is varying with the implementation of the SVPWM technique in the STM32F4 microcontroller by maintaining the V/F constant. The synchronous speed of the input supply frequency of the induction motor is given by

$$N_s = \frac{120f}{p} \qquad (1)$$

where N_s : Synchronous speed (r.p.m), f: Fundamental frequency (Hz), p: Number of poles.

The difference between the synchronous speed and the rotor speed of the induction motor is called as slip, S and is given by

$$S = \frac{N_s - N_r}{N_s} \qquad (2)$$

and the rotor speed, N_r of the induction machine is given by

$$N_r = \frac{120f(1-S)}{p} \qquad (3)$$

The inverter drive input is fed with the DC source obtained from the solar PV array to generate the three-phase AC output voltage which will drive the three-phase AC induction machine for water pumping applications at remote areas where there is non-availability of distribution power. The speed of the AC induction machine depends on the frequency of the input AC supply which is a function of the input DC voltage of the solar PV array. The inverter output voltage, V_O is given by [8]

$$V_O = \frac{\sqrt{3}}{\sqrt{2}} \times MI \times \frac{1}{2} \times V_{DC\_link} \qquad (4)$$

where MI: Modulation Index, V_{DC_Link}: Input DC voltage from the solar PV array.

The inverter output power, P_{out} is given by [8]

$$P_{Out} = \sqrt{3} \times V_O \times I_{rms} \times PF \qquad (5)$$

whereVo: Inverter line to line output voltage, I_{rms}: Maximum load of the inverter, PF: Power factor.

To maximize efficiency, the solar array has to operate at maximum power point (MPP), which extracts the maximum power and delivers to the load. An incremental conductance control algorithm is used in this project as it has more efficient and good stability over perturb and observe control algorithm [2].

Hardware is designed, implemented and a control algorithm is developed in the STM32F4 based microcontroller to control the drive for the required application.

I. DESIGN AND IMPLEMENTATION OF SOLAR MOTOR DRIVE

A. *Main Components of Solar Inverter Drive*

In this solar inverter drive, a DC input voltage is supplied to the inverter with a capacitor filter used at the input side of the inverter. The six PWM gating signals are fed to the power electronic switches such as IGBT, MOSFET, GTO, etc. The inverter output feeding induction motor and the concept of the process are explained as follows.

a. *Solar PV Array*

Some solar panel are connected in series to form a solar PV array of rated voltage 576V (16 panels of rated voltage of 36V each and open-circuit voltage of 44V each) is supplied to the inverter as the input source.

b. *DC Link*

The capacitoris connected in shunt across the inverter and this type of topology is called avoltage source inverter (Figure 1). The capacitor acts as a DC link and compensates the transient voltages across the inverter [1].

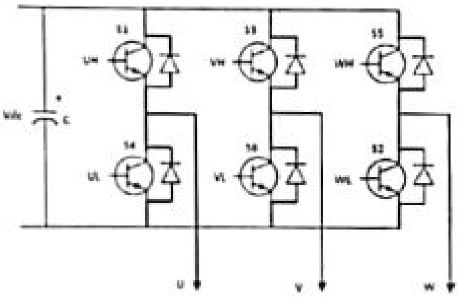


Figure1. Voltage Source Inverter

c. *Inverter*

The main part of the inverter is the power electronic switches such as IGBT is coupled with a parallel diode. An integrated power module (IPM) FSBB10CH120D [6] is used as an inverter which comprises a 3 phase fully controlled IGBT-based inverter bridge integrated with high-speed IGBT drivers. These integrated power modules have inbuilt IGBT drivers that can be operated directly by the 3.3V microcontroller. With the latest developments in power electronics, integrated power modules reduce the size and are compact for designing the 3 phase low power drives up to 7.5kW with reduced EMI and losses. And also these are integrated with temperature sensing and fault sensing protection features. These integrated power modules are capable of developing different motor applications with a wide variety of control algorithms [6] [8].

d. *STM32F4 based Microcontroller*

In this project, STM32F411RE microcontroller board (NUCLEO-F411RE development board) [10][18] is used to implement the control algorithm to drive the induction motor.

e. *DC to DC Converter Control Supply*

Control supply is derived from the input DC source voltage by using DC/DC SMPS power supply to run the microcontroller and other control circuits which are at low voltages. Mainly the control supplies required are +15V DC for IGBT Driver control, +5V DC for the microcontroller, and +3.3V DC for Op-Amp circuit for voltage and current signals magnification [6][8].

B. *Hardware Implementation*

A 1.5kW solar induction motor drive is designed and implemented using the integrated power module FSBB10CH120D with minimum circuitry [6][7][8].

C. *Control Strategy*

In this proposed system, a voltage source inverter is fed with the solar input DC voltage and the gating pulses of the VSI are generated by the microcontroller. A block diagram is shown in Figure 2.

Input DC voltage and current from the solar PV array are measured using the microcontroller ADC input and used to estimate the maximum power using incremental conductance algorithm (MPPT) algorithm[2].

INC algorithm is used to estimate the frequency of the inverter output. From the estimated frequency, the microcontroller generates the required gating pulses for the inverter using constant V/F principle and SVPWM technique.

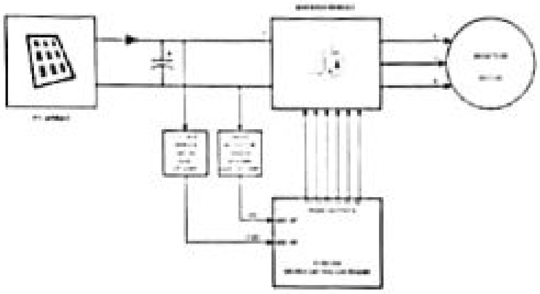


Figure 2. Block Diagram

V/F ratio is to be maintained constant to have a constant stator magnetic flux. If varying only the frequency to control the speed at fixed rated voltage leads to the saturation of the magnetic core results in low performance of the motor or even may cause damage to the motor due to overheating [1][3].

$$V_{Ph} = 4.44kfN\emptyset_m \quad (6)$$

$$\frac{V_{Ph}}{f} = 4.44kN\emptyset_m \quad (7)$$

And

$$T = k\emptyset_m I_2 \quad (8)$$

Where $\emptyset_m$ Magnetizing flux, N: Number of turns per phase, V_{Ph}: Stator voltage, k: constant depend on the machine design, T: Shaft Torque, I_2: Rotor Current depends on the load.

From the above relation, it is evident that the V/F ratio must be maintained to be constant to avoid the saturation of the core at all speeds below the rated speed.

D. SVPWM implementation

The SVPWM control algorithm is implemented based on the sector selection method [1] and the equations for switching time duration at any sector is given by the equations 9, 10, and 11.

$$T_1 = \sqrt{3}\frac{V_{xy}}{V_{DC}}T_s\sin\left(\frac{n\pi}{3} - \theta\right) \quad (9)$$

$$T_2 = \sqrt{3}\frac{V_{xy}}{V_{DC}}T_s\sin\left(\theta - \frac{(n-1)\pi}{3}\right) \quad (10)$$

$$T_0 = T_s - T_1 - T_2 \quad (11)$$

Where T_1, T_2 and T_0 are the switching time durations, T_S is the sampling time period of the switching frequency (f_S), V_{DC} is the solar PV array input DC voltage, V_{xy} is the space reference voltage, n is the sector number ranges from 1 to 6 and Θ is the sub-sector angle varies from 0 to 60 degrees. The modulation index is given by

$$MI = \frac{\sqrt{3}V_{xy}}{V_{DC}} \quad (12)$$

After calculating the switching time durations T_1, T_2 and T_0, determine the switching time of each IGBT from S1 to S6 [1]. The switching sequence pattern for each IGBT is shown in Figure 5. The switching time for each sector is shown in Table 1.

Sector (n)	Upper switching (S_1, S_3, S_5)	Lower Switching (S_4, S_6, S_2)
1	$S_1 = T_1+T_2+T_0/2$ $S_3 = T_2+T_0/2$ $S_5 = T_0/2$	$S_4 = T_0/2$ $S_6 = T_1+T_0/2$ $S_2 = T_1+T_2+T_0/2$
2	$S_1 = T_1+T_0/2$ $S_3 = T_1+T_2+T_0/2$ $S_5 = T_0/2$	$S_4 = T_2+T_0/2$ $S_6 = T_0/2$ $S_2 = T_1+T_2+T_0/2$
3	$S_1 = T_0/2$ $S_3 = T_1+T_2+T_0/2$ $S_5 = T_2+T_0/2$	$S_4 = T_1+T_2+T_0/2$ $S_6 = T_0/2$ $S_2 = T_1+T_0/2$
4	$S_1 = T_0/2$ $S_3 = T_1+T_0/2$ $S_5 = T_1+T_2+T_0/2$	$S_4 = T_1+T_2+T_0/2$ $S_6 = T_2+T_0/2$ $S_2 = T_0/2$
5	$S_1 = T_2+T_0/2$ $S_3 = T_0/2$ $S_5 = T_1+T_2+T_0/2$	$S_4 = T_1+T_0/2$ $S_6 = T_1+T_2+T_0/2$ $S_2 = T_0/2$
6	$S_1 = T_1+T_2+T_0/2$ $S_3 = T_0/2$ $S_5 = T_1+T_0/2$	$S_4 = T_0/2$ $S_6 = T_1+T_2+T_0/2$ $S_2 = T_2+T_0/2$

Table 1. Switching Time for Each Sector

E. Software Implementation

Software embedded C code has been written in the STM32CubeIDE software using HAL libraries [16]. Peripheral initialization codes are generated for ADC inputs and output Timer channels are done through STM32CubeIDE software [17].

The control algorithm developed for this application is writ in C code /Mat lab and uploaded to the microcontroller. The flow chart of the control algorithm is given in Figure 4.

The control algorithm structure is as follows:

The program execution starts with the initialization of peripherals, ADCs and Timers. The interrupt service routine (ISR) program will execute for every sampling period

The microcontroller is set to operate at 84MHz clock frequency to run the program code [17] [18]. Initially, the Timer of the microcontroller is set to 5 kHz switching frequency and the duty of the pulse width is determined by using the equations 9, 10, and 11 with proper choice of sector developed from the constant V/F principle and SVPWM technique.

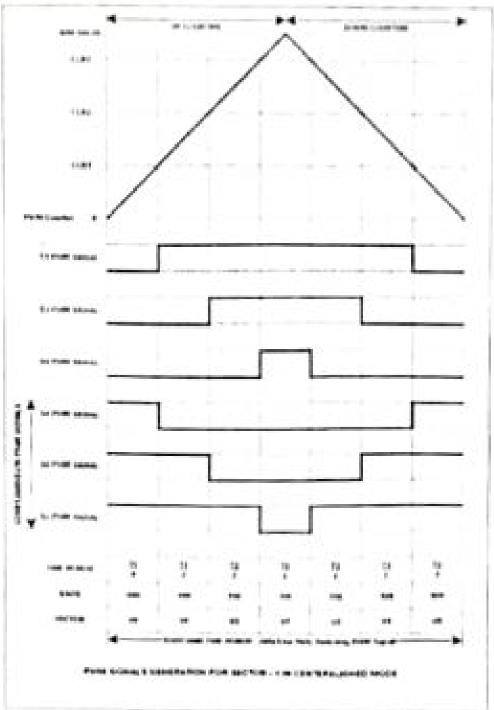
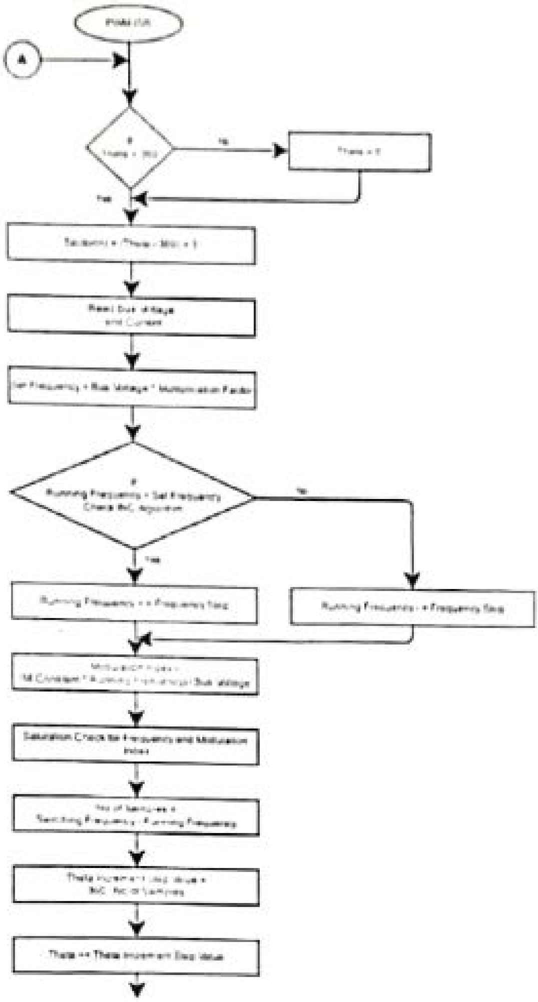


Figure 3. PWM Signals generation for gating in Sector-I

The Timer channels are configured in center-aligned PWM mode with complementary channels made active for generating the required gating PWM signals for the inverter. The Timer must be configured in Advanced Timer mode with trigger mode made active to synchronize the other timer for the periodic sampling of analog to digital converter (ADC) signals. When the Timer is in center-aligned mode, up-counting starts from zero reaches to the ARR value (Auto Reload Register) and an update event is generated, and then down-counting starts from the ARR value reaches the zero value. This update event is used to trigger to start the ADC conversion process. After the completion of down-counting, an interrupt is generated to start the next period at which the calculations start again. Figure 3 represents the switching time durations of the IGBTs of the sector -I in relate to the Timer counter.

Dead-time or blanking time is set and inserted between the complementary signals to avoid inverter leg short during the transition between ON and OFF of the IGBTs of the same leg. A dead time of around 2 microseconds [6] is set in the control algorithm.

Two analog to digital converter(ADC) channels are configured to measure the solar PV array voltage and current signals for evaluation of maximum power using the INC algorithm. ADCs are to be triggered at the center of the current switching period for the sampling of the signals. After completion of the ADC sampling conversion, ADC conversion process is made inactive up to the next triggering. These conversion values are stored at the respective memory locations and are fetched during the calculations instructions.


A
Set Frequency = Bus Voltage * Multiplication Factor
Saturation Check for Frequency and Modulation Index
Theta += Theta Increment Step Value

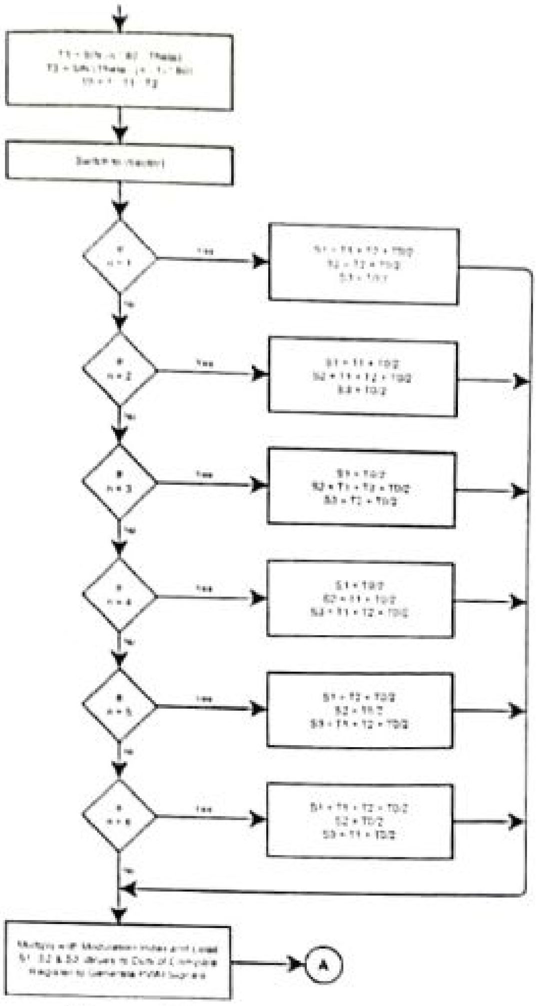


Figure 4. Flow Chart for PWM ISR Program

The solar PV array voltage and current are having high potential and are not directly used to measure by the microcontroller. These values must be brought down to sufficiently lower values at which the microcontroller can measure. Bus voltage of 600V scaled to 2.5V and bus current of 10A scaled to 3.0V fed to the microcontroller ADC input which is measured up to 3.3V with 12-bit resolution.

Sine value lookup table is implemented with a resolution of 0.23 deg (60 degrees / 256 entries) are preloaded in to the data memory which are used in calculating the switching time durations. This lookup table will helps in minimize the calculations burden on the CPU thus by improves the performance [19]. The range of the sine value is limited to 60 degrees after which the sector change will take place in case of SVPWM technique.

The idle starting of the motor has set to pick up the speed gradually up to the maximum output speed in a ramping fashion such that no hunting will occur. The ramping time has to set according the stable motor speed and current changes. In the similar way, the motor has to be stopped gradually by reducing the speed reaches to zero.

References

[1] Ahmed K. Ali and Ergun Ercelebi, Simulation and study of SVPWM Inverter for VFD Applications, *International Journal of Electrical and Electronics Engineering, Vol. 5, No. 2,* April 2017.

[2] SaurabhShukla and Bhim Singh, Solar PV Fed Sensorless DTC of Induction Motor Drive for Water Pumping, *Conference: 2017 IEEE Industry Applications Society Annual Meeting,* October 2017.

[3] B. K. Bose, *Modern Power Electronic and AC Drives,* Pearson Education, 2003.

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[17] User Manual, *UM2609STM32CubeIDE User Guide,* STMicroelectronics, Rev. 4, July 2021.

[18] User Manual, *UM1724STM32 Nucleo-64 boards (MB1136),* STMicroelectronics, Rev. 13, April 2019.

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[20] Carmine Naviello, Mastering STM32 A step-by-step guide to the most complete ARM Cortex-M platform, using a free and powerful development environment based on Eclipse and GCC, Leanpub, Release 0.18, 2015-2016.

Section C: Financial requirement (all figure must be INR)

S. No	Item Head	1st Year	2nd Year	Total (in lakh)
Capital Component				
1	Permanent Equipment *(located in lab/ implementing organization) as per billing*	50,000.00	-	50,000.00
2	Fabricated systems/ demonstration models *(located at beneficiary location)*		1,25,000.00	1,25,000.00
A'	*Sub total (capital items)*	50,000.00	1,25,000.00	1,75,000.00
General Component				
1	Manpower and Contingencies	1,20,000.00	1,20,000.00	2, 40,000.00
2	Consumables	25,000.00	25,000.00	50,000.00
3	Travel	15,000.00	15,000.00	30,000.00
4	Overhead	10,000.00	10,000.00	20,000.00
5	PC	-	-	-
6	Printer and scanner	10,000.00	-	10,000.00
B'	*Sub total (General)*	1,80,000.00	1,70,000.00	
C	**Total cost of the project (A'+B')**			5,25,000.00

I. ***Project cost:*** **Rs; 5,25,000.00**

II. ***Contribution of consortium (if any):*** **-**

Total Budget (I +II) : ***Rs.*** **5,25,000.00/-**

Section D: Applicant Details

Name of the Lead Organization	AVANTHI COLLEGE OF ENGINEERING AND TECHNOLOGY	
Address *Please include phone numbers, fax, emails and website*	TAMARAM(V), MAKAVARAPALEM (M), VISAKHAPTNAM -531113. Principal_aiet@yahoo.com Phone: 08932-222382 Website: www.avanthi.edu.in	
Applicant Type *Broad: Government / Non-Government Sub entity : Academic or research institution*	**ACADEMIC INSTITUTION**	
Primary Point of Contact **Lead Principal investigator (PI)**	Name:	Dr.SRINIVASA RAO TEGALA
	Designation	PROFESSOR
	Email	srinivasarao_tegala@yahoomail.co.in
	Telephone:	08932222555
	Mobile:	09963000511
Secondary Point of Contact	Name:	Dr.C.P.V.N.J.Mohanrao
	Designation	Principal
	Email	principal_@yahoo.com
	Telephone:	08932-222382
	Mobile	9849147304

Information on Lead PI	Expertise available with the Principle Investigator Prof. P.Mallikarjuna Rao, Dept. Of Electrical Engineering, Andhra University is the Research supervisor for the doctoral research of the PI, he would mentor the proposed research project from timeto time. The Principle Investigator has gained good knowledge on EV systems and its related areas. 1) PI as an Instructor guided one students during his course of study (PhD) in Andhra University. ➢ Guided two M.Tech project students based on his research area. ➢ Guided two B.Tech project students out of his research area. 2) During his research, PI has acquired knowledge of many simulation software's used them for the above said project works. The tools learned by PI are as follows: Computational skills: Simulation Software: MATLAB and Lab-View Word Processing: MS Office

20/6/2021

Principle Investigator

Head of the Department
Department of Electrical & Electronics Engg.
Avanthi Institute of Engg & Tech.
Makavarapalem, Visakhapatnam - 531113.

Principal
Principal
Avanthi Institute of Engg. & Technology
Tamaram, Makavarapalem Md.,
Visakhapatnam District, Pin-531113

1. Annexure 1: Monitoring and Evaluation approach

Time Schedule of activities giving milestones through BAR diagram									
S.L. NO	WORK PLAN	Duration (in Months)							
		1 to 3	4 to 6	7 to 9	10 to 12	13 to 15	16 to 18	19 to 21	22 to 24
1	Basic study of the literature related to the project implementation, consolidation of the available expertise. Planning of execution of the proposed project scheme.								
2	Procurement of experimental equipment and installation								
3	Design of basic simulation of project and control strategy using Matlab.								
4	Implementation of PV project andOperational control of the test facility Using MATLAB.								
5	Annual review of the progress of the project and effective guidance for implementation. Mile stone-1 (in addition to regular)								
6	Commissioning of the Project hard ware.								
7	Testing of the project and code.								
8	Experimental validation of the Project. Mile stone -2								
9	Report writing.								

Head of the Department
Department of Electrical & Electronics Engg.
Avanthi Institute of Engg & Tech.
Makavarapalem, Visakhapatnam - 531113.
Principle Investigator

Principal
Principal
Avanthi Institute of Engg. & Technology
Tamaram, [illegible]
Visakhapatnam District [illegible]

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY,
MAKAVARAPALEM, VISAKHAPATNAM, INDIA

S.No.	Infrastructural Facility	Yes/No/ Not required Full or sharing basis
1	Workshop Facility	Yes
2	Water & Electricity	Yes
3	Laboratory Space/Furniture	Yes
4	Power Generator	Yes
5	AC Room or AC	Yes
6	Telecommunication including e-mail & fax	Yes
7	Transportation	Yes
8	Administrative/ Secretarial support	Yes
9	Information facilities like Internet/Library	Yes
10	Computational facilities	Yes
11	Animal/Glass House	Not Required
12	Any other special facility being provided	Dedicated Renewable Energy Systems laboratory

2/4/24

Principle Investigator

Head of the Department
Department of Electrical & Electronics Engg.
Avanthi Institute of Engg & Tech.
Makavarapalem, Visakhapatnam - 531113.

Principal

Principal
Avanthi Institute of Engg. & Technology
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Visakhapatnam District, Pin-531113

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(Approved by AICTE, Permanently Affiliated to JNT University, Kakinada, Accredited by NBA & Recognized Under 2(f) and 12(b) by UGC, New Delhi)
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Administrative Office : 51-8-40/21/2, Rythu Bazaar Street, Beside Eenadu Office, Nakkavanipalem, Visakhapatnam - 530 013 (A.P.) Ph : 0891-2748231, 9652012340
e-mail : principal_aiet@yahoo.com Website : www.avanthi.edu.in

Dt: 19.04.2021

AIETM/03/2021/EEE/PROJECT/02

To,

The Surya Vardhan Integrations,

Narsipatnam

Visakhapatnam

Sub: Details of Project coordinator of Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications.

Respected Sir,

We are pleased to appoint faculty for coordination of Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications. We are happy to submit detailed proposal along with the milestones of EV Controller Design and Prototype.

Details of the Faculty:
Petla Varahala Dora, Assistant Professor
Department of EEE
Phone Number: 8520028666
Thank you and looking forward for your collaboration.

Principle Investigator

Head of the Department
Department of Electrical & Electronics Engg.
Avanthi Institute of Engg & Tech.
Makavarapalem, Visakhapatnam - 531113.

Dt: 22.04.2021

To,

The Principal,

Avanthi Institute of Engg & Tech,

Tamaram, Makavarapalem,

Narsipatnam.

Sub: Communication for detailed discussion of Design and hardware Implementation of Solar Powered Induction Motor Drive Water Pumping Applications proposal.

Respected Sir,

With reference to communication along with detailed submission of project milestones. We are pleased to invite for an internal discussion on execution of the project and other design and implementation regarding development of Solar Powered Induction Motor Drive Water Pumping Applications. We are deputing Engineer for the above state of project.

Details of the Engineer:
Petla Vishnu Vardhan
Phone Number: 9550175252

Thank you and looking forward for your response.

Regards,

(Sesh kumar Petla)
Managing Partner
The Surya Vardhan Integrations.