Hardcarb®
Surfacing. Automation. Innovation.

PUR/05/Rev No. 00

Ref. No: VS/18-19/G13562
Date: 05/12/2018

Bartiya Vidya Bhavan's Sardar Patel Institute Of Y
Munshi Nagar,
Andheri (W) ,
Mumbai

WORK ORDER

As per the MoU signed between **Hardcarb Technologies Pvt Ltd** and **Sardar Patel Institute of Technology** dated December 05, 2018, we hereby agree to the following project schedule and payment terms:

Title of the Project: **Design and development of a 24V/15A DC Motor PWM drive for PMDC OR Shunt DC Motor**

PROJECT COST

The total project cost is Rs. 1,85,000, including the cost of proto-type, hardware, software & technology transfer as defined in MOU.

Government Taxes

(a) GST will be at actual extra on total project cost
(b) TDS will be deducted on total project cost as per Income Tax rule

Payment Schedule:

i) Rs. 25,000 at the start of the project, at the time of signing MOU

ii) Rs. 60,000 after the completion of first phase of two months

iii) Rs. 50,000, after the completion of second phase of one month

iv) Rs. 50,000 after field trial and handing over the TOT documents etc.

v) An invoice will need to be raised along with GST for claiming payment against every phase.

vi) From all above schedule payments TDS will be deducted @ 10%

Therefore, as a first installment as per the terms of Mou, we are sending herewith a Cheque of Rs. 25000/-, in favor of "**Principal, SPIT Allied Services**", to start the execution of the Project.
Cheqe. No. 009387 Amount: Rs. 25000/-
Date: 05.12.2018
Bank Name and Branch: HDFC Bank Ltd., Sion Circle,Mumbai

Please accept the amount and acknowledge the receipt of payment

Headquarters:
R 728, TTC Industrial Area,
MIDC Rabale, Navi Mumbai
400701, Maharashtra, India
CIN: U28920MH1999PTC122518

Phone:
+91 22 27642431
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Email:
info@hardcarb.com
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Our GST ID No : **27AAACV9024A1ZN**

IMPORTANT TERMS RELATED TO GST:

- Correct HSN/SAC code shall be mentioned in Tax Invoice.
- Tax invoice shall be submitted in a timely manner to us.
- Utmost care shall be taken while uploading the data on GST portal to avoid mismatching of data and loss of credit.
- In case of mismatch of data uploaded on GST Portal, corrective action shall be taken immediately under intimation to us.
- In case of denial of GST Credit by GST Department because of your noncompliance and/or failed to take corrective action, equivalent amount of tax credit along with interest or penalty, if any, imposed by GST Department will be recovered from your due payment.

We trust you will find the above in order. Please send us your acceptance of order.

Prepared By

Checked By

For Hardcarb Technologies Pvt Ltd

Amit R. Shah
Director- Operations

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Memorandum of Understanding

This memorandum of Understanding (MOU) is signed on day of 5h **December** 2018, between:

Hardcarb Technologies Pvt Ltd (HTPL), R 728, TTC Industrial Area, MIDC Rabale, Navi Mumbai 400701, Maharashtra, India, a company working in Surfacing, Automation. Innovation, etc.

And

Sardar Patel Institute of Technology, (SPIT), Munshi Nagar, Andheri (West), Mumbai-58, a self-financed Engineering institute affiliated to Mumbai University and managed by Bhartiya Vidya Bhavan, a charitable trust.

Hardcarb Technologies Pvt Ltd: Background and Credentials:- Since close to 2 decades, Hardcarb Technologies (formerly Vautid-Shah Hardface Pvt. Ltd.) has been acting as a one-stop-shop for all procedures of wear protection. The 360 degree product spectrum encompasses all solutions to combat abrasion, erosion and impact associated with temperature and/or corrosion problems. The product mix ranges from deposition welding materials to composite wear plates to wear-resistant cast products. High end cladding techniques, robotic SPM's, automatic re-conditioning of worn components are also part of Hardcarb's core competencies. Focus markets: Cement plants, Steel plants, Coal-based power plants, Mines etc. Specialties: Wear-protection solutions, Welding & Cutting automation, Reverse Engineering, composite wear plates, wear consulting, hardfacing stick electrodes, hardfacing flux-cored wires.

Sardar Patel Institute of Technology: Background and Credentials

Sardar Patel Institute of Technology (SPIT) is an AICTE recognized college spread over a campus of 47 acres and is an Autonomous College affiliated to the Mumbai University. It imparts various degree courses in Engineering and also certificate courses. SPIT aspires to be one of the premier R&D organization in the academic world.

It is also involved in Research and Development in the area of Embedded Systems, VLSI design, Power Electronics, Software Technology and related areas of computer science. Its focus is to help create cutting-edge Technologies and offer advanced training for students, Government and Industry.

Alliance Objective

The scope of the MoU, the roles and responsibilities of the parties of the MoU are given below

1. HTPL and SPIT will engage mutual cooperation in Research and Development primarily in the field of Embedded Systems, Instrumentation & automation, Power Electronics, Industrial Electronics, Communication and Computing.
2. HTPL agrees to offer internship towards the student community of SPIT that is mutually beneficial.
3. Research and new product development activities and joint research projects to be undertaken, funding for which will be provided by HTPL, SPIT will offer infrastructure, research human resource and laboratory facilities whenever necessary for a prescribed limited period.

Current Project Statement

HTPLis currently looking for the Design and development of a 24V/15A DC Motor PWM drive for PMDC OR Shunt DC Motor with four-quadrant operation features with a option of dynamic braking with all the necessary annunciation, communication and protection as per industry standards. (Annexure-1)

In this context through this MOU, SPIT will develop the system within a span of 4-months. The hardware cost is included in the project cost. SPIT project team shall work on both speed and torque control loops with appropriate signal conditioning and feedback, the system would be implemented with a DSP Microprocessor platform. The stator is fed from a PWM Converter. Front-end Rectifier+ DC-DC Converter is additionally implemented to enable the operation from 230V, Single Phase AC Mains.

The TOT transfer be the handover of relevant working software/firmware on the designed system with documentation on functional explanation of each piece code block-wise for future reference and modifications, if any.

The hardware material means Inverter Bridge assembly, driver board , HF Transformer, CTs, Test Load, etc. SPIT team shall purchase discrete components at their end, as and when required in the consultation with HTPL project -team and raise the necessary bill against the invoice submitted to HTPL.

PCB Art work design will be the job of SPIT team, this is in their scope of work SPI team will handover all the necessary PCB design files during TOT for future modifications, if any.

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Project Implementation Schedule and Commercials

Specifications: As per Annexure-1

Title: Design and development of a 24V/15A DC Motor PWM drive for PMDC OR Shunt DC Motor with four-quadrant operation features with a option of dynamic braking with all the necessary annunciation, communication and protection as per industry standards.

The proposed DC Drive is air cooled, high conversion efficiency, safety, protection, temp, shock and vibration, as per adequate standard (CE and ISI).

This converter shall have output short circuit, over temperature, over and under voltage protection with relevant speed and torque feedback.

Control : Both speed and torque control loops with appropriate signal conditioning and feedback implemented with a DSP Microprocessor platform. The stator is fed from a PWM Converter. Front-end Rectifier+ DC-DC Converter is additionally implemented to enable the operation from 230V, Single Phase AC Mains.

Schedule:

(a) This is a **Four months** project having total three phases

(b) The **First Phase** is of **two months** and executes following task:

Design of schematic design, mechanical design and PCB design with the aid of literature survey, computer simulation, Ordering and assembling components and subsystems, etc.

(c) The **second phase** would be of another **one month** required for:

Hardware testing, programming firmware and integrated testing, fine-tuning the parameters for desired specifications.

(d) The **third stage** is a Final stage of **one-month** duration utilisedfor :

Final testing, packaging and field testing.Preparation of report / design documents, etc as per various test parameters.Handover of TOT documents.

Financial: All the hardware cost is included in the project except the motor cost. The final testing facility and its related cost should be borne by Hardcarb Technologies Pvt Ltd.

The total estimated hardware prototype cost is Rs. 60,000, including development boards, PCB design and manufacturing cost for all the iterations excluding government taxes if any.

The project implementation, HR and technology transfer cost is Rs. 1.25 Lacs.

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The total project cost is Rs. 1,85,000, including the cost of proto-type and HR but excluding the Govt. taxes on all the relevant hardware material being procured during prototyping.

Payment Schedule: Advance: Rs: 25k, First Phase:60k, Second Phase:50k, Last Phase: 50k

(a) Rs. 25,000 at the start of the projects, at the time of signing MOU
(b) Rs. 60,000 after the completion of first step of two months and submission of PCB Schematic, Board design files & BOM to HTPL.
(c) Rs. 50,000, after the completion of second stage of one month.
(d) Rs. 50,000 + Govt. Taxes after completion of third stage of one month, which includes field trial and handing over the TOT documents etc.

(All the payments should be made in favor of Principal, SPIT, Allied Division after signing an MOU between both the parties).

SPIT PROJECT TEAM:

Principal Investigator:

(1) Dr.Rajendra R Sawant
Professor,
Department of Elect.and Telecommunication Engg.
Sardar Patel Institute of Technology,
Munshi Nagar, Bhavans Campus, Andheri (W), Mumbai-58
022-26708520/2628 7250 (Ext: 390).

Mob: 9920247002
Email: rajendra.sawant@spit.ac.in, rrs1902@gmail.com

Co- Principal Investigators:

Co-Investigator (1)
Dr. Y S Rao,
Professor,
Dept. of Electronics & Telecom
SPIT, Mumbai
ysrao@spit.ac.in

Co-Investigator (2)
Dr. RajendraSutar,
Associate Professor,
Dept. of Electronics
SPIT, Mumbai
rajendra_sutar@spit.ac.in

HTPL PROJECT TEAM

Mr. Rishi Shah,
Director - Automation

rishi@hardcarb.com

Annexure-1: Specifications

Specifications

Characteristic	Symbol	Required Value	Unit
Max. Output Power	P_{out}	400	W
Input AC Voltage nominal, Single Phase, 50HZ	V_{nom}	230	V, RMS
Maximum Input voltage	V_{max}	270	V, RMS
Minimum Input voltage	V_{min}	85	V, RMS
Maximum input current	I_{max}	5	A
MotorVolt/Current		24V / 15A DC	
Motor Torque		11	N.m
Motor-type		PMDC (Geared/withoutGear)	
Speed Sensing		Tachogenerator,HallEffect,Back EMF	
Speed Reference	Settable	Pot, +/- 10V from PLC, Ethernet, SPI	
Braking		Dynamic (Regeneration, if possible)	
Operating ambient	T_{amb}	0-55 degrees	C
Efficiency	η	95%	
Communication		CAN, Ethernet, SPI	
Height		TBD	mm
Width		TBD	mm
Length		TBD	mm
Cooling Arrangement		Air Cooling with Heatsink at the bottom, preferably natural cooling	
Shock & Vibration		TBD	
EMC standard	CISPER 25	The system shall be designed to CISPER 25	
Safety standard	IEC 60664-1	Insulation coordination	
PCB	IPC2221	Printed circuit board, 4 Layer	

Note: The input power stage shall employ use of some form of high frequency chopping mechanism to convert 85-270VAC to low power which will further be used for the rectification to DC. Standard bulky isolation transformers shall not be employed.

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Mutual Obligation

1. This MoU may be terminated by either party through a notice of one month. Either party may terminate this MoU if either of the parties is frustrated by reasons beyond its control from going ahead with the implementation of the provision of this MoU.

   NOTE: If the MOU is terminated for any reasons, then HTPL is entitled to receive all the details of the work done till then including the PCB Schematics, Board files, BOM, and other relevant information. If HTPL has given any material to aid testing or development to SPIT then it shall be returned back to HTPL.

2. There shall be no liability on the part of any party to the other arising from the termination of this MoU.

3. This agreement may not be amended without the prior written consent of both the parties.

4. Neither party shall issue any press release, public announcement or other such disclosure concerning this agreement without the other party's consent as to such release or announcement.

5. SPIT will sign a Non-Disclosure Agreement (NDA) necessitated to protect IPR and essential information safeguards from both sides.

6. SPIT team shall be free to employ external consultant on paid basis, if required, in specific circumstances to meet the strict time-line for project completion without violating NDA document terms and with no extra liability on the first party (HTPL).

7. Intellectual Property Rights: IPR titles or ownership of any products, proprietary information or technology tools, processes, utilities, and methodology including any HTPL proprietary products or components thereof used hereunder or development of any deliverables and all new ideas, inventions, innovations, or developments conceived, development or made by HTPL hereunder will not be transferred from HTPL to the Institute on account of use of the same as part of any work under this MoU and shall always remain with HTPL

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Summary

Hardcarb Technologies Pvt Ltd recognizes the significance of **SPIT** initiative to be the leader in the field of Education in Electronics, Communication and Computer Engineering and academia in the country. HTPL proposes to provide an opportunity to the SPIT faculty and students to work on live projects and learn the necessary skill-set essential as per the new technological trends in the country.

This Memorandum of Understanding is intended to express the broad understanding of the parties regarding their working with each other to the extent possible for their mutual benefit.

In written whereof both parties put their hard seal on the day, month and year herein mentioned.

Date: December 5, 2018

Principal

Sardar Patel Institute of Technology,

Bhavan's Campus, Munshi Nagar

Andheri (West), Mumbai-58

E-mail: principal@spit.ac.in

Telephone: (022) 26708520 Ext: 305

Signature:

Mrs. Dr. Prachi Gharpure

For SPIT, Mumbai

Director - Automation,

Hardcarb Technologies Pvt. Ltd.
(Formerly Vautid-Shah Hardface Pvt.Ltd.)

R 728, TTC Industrial Area, MIDC Rabale, Navi Mumbai 400701, Maharashtra, India.

Email: rishi@hardcarb.com

Signature:

Mr. Rishi Shah

For Hardcarb Technologies Pvt Ltd