Jash **Shah**

EMBEDDED SYSTEMS · ROBOTICS · AI-ML · BLOCKCHAIN · ELECTRONICS

2130, Ram Bhavan, BITS Pilani, Pil Rajasthan, India - 333031

(+91) 98258-46159 | jashshah0801@gmail.com | Jash-2000.github.io/Jash-Shah.me | Jash-2000 | jash-shah-98ab171a0

*"THE BEST WAY TO **PREDICT** THE FUTURE IS TO **INVENT** IT"*

Education

BITS Pilani (Birla Institute of Technology and Science, Pilani)   *Pilani, Rajasthan, India*

B.E.(HONS.) IN ELECTRONICS AND INSTRUMENTATION ENGINEERING   *Aug. 2018 - May. 2022*

- Among **top 0.15%** of Indian Candidates who got admitted to ENI, BITS P, with a BITSAT score of 330/450.
- My major is a unique combination of 2 circuit branches (i.e. Electronics and Instrumentation Control) which gives me the capability to understand the complete ecosystem of a cyber physical system, **starting from gate level design to high level control paradigms**.
- My current **CGPA is 7.7/10**, when the **course averages are 6.0/10**.
- Completed my compulsory course on **Technical Report writing and Business Communication**, thus, clearing the basic **English Proficiency level**.

Shiv Ashish Higher Secondary School   *Ahmadabad, Gujarat, India*

HIGHER SECONDARY EDUCATION   *March. 2017 - May. 2018*

- Scored **96.2% (PCM)** in class 12 National Examination affiliated by the Central Board of Secondary Education **(CBSE)**.
- **Major in Physics, Mathematics and Chemistry**.

Workshops and Presentations

TinyML Professional Certification   *HarvardX*

PARTICIPANT OF THE TINYML SYMPOSIUM BY VIJAY JANAPA REDDI   *Jan. 2021*

- Learnt about various differences in implementing Machine Vision and Computer Vision.
- Implemented Image Super Resolution Using Autoencoders in Keras.
- Scripted in TensorFlow Lite for micro controllers to create and deploy Embedded Devices with Responsible AI.
- Currently implementing an ongoing challenge to develop the machine vision for sorting items to aid an industrial robotic arm.

Pest control using advanced UAV in WSN   *BITS Pilani, India*

TERM PAPER PRESENTATION FOR TRANSDUCERS AND MEASUREMENT SYSTEM   *Jan.2021*

- Developed a camera mounted quad copter, with variable rate pesticide sprayer, capable of wireless ad-hoc communications with the bio-sensors embedded in soil. The control system for the sensors were simulated in MATLAB.
- A Laplacian artificial field algorithm was used as drone's primary path planning algorithm.and Fractional Order PID, optimized using Simulated Annealing was used to control the drone's locomotion

Review of ML based Latency aware task assignment in FoG nodes   *BITS Pilani, India*

KEYNOTE SPEAKER AND SHORT PAPER PRESENTER   *Jan.2021*

- Project under Dr. G.S.Sesha Chalapati
- Presented a short paper for implementing optimized latency free task division in Edge-Fog-Cloud architecture.
- Explored the use of Unmanned Aerial Vehicles(UAVs) as base stations for providing network portability.

Development of an Improved Thermometric Generator   *Pilani, India*

KEYNOTE SPEAKER AND PAPER PRESENTER   *Dec.2020*

- Presented my ideas on improvements of TEG design using dynamic heat transfer equations, using Transistorial approaches.
- Received funding from Dr.Sujan Yenuganti, (Assistant proffesor, BITS P), for my research work.

Dynamic Online Credit Scoring System using Multi-level Blockchain   *TLC, Pilani*

1ST AUTHOR UNDER SUPERVISION OF DR. AMIT DUA (PI)   *Nov. 2020*

- Pitched the Teaching and Learning Centre at BITS Pilani, with advanced system for calculating the teaching credit scores by using dynamic components.
- The framework utilized an modified form of ELO system, aided with a 3-tier blockchain architecture which provided an robust, secure and optimized teaching scoring system.
- The framework utilized Big-Data and Active learning techniques, over a multi-level blockchain.

CES Asia 2019   *Shanghai, China*

INDUSTRY ATENDEE   *May. 2019*

- Attended the CES Asia, to gain industrial exposure and learn about recent developments in the Technological Sectors.
- Built my network with various Swiss based startup groups and research giants.
- Part of various launch events and keynote speeches, including that of Huwaii 5G and concept cars by Mercedes Benz and AUDI.

Research Experience

Automatic Indoor Semantic mapping by a mobile robot unit to create 2.5-D maps
INSPIRE Lab, BITS Pilani

RESEARCH PROJECT IN THE EMBEDDED SYSTEM AND ROBOTICS LAB, UNDER SUPERVISION OF DR.AVINASH GAUTUM
Dec. 2020 - Present

- **Visual and Textual semantics**, along with **Lidar-SLAM** is being used to develop a 2.5-D map over a 2-D map available through GIS services.
- Exploring **MobileNets** to implement a light-weight, **embedded Neural Network**. This would be used with a **RGB-D stereo camera**, mounted over a mobile robotic unit.
- Designing **YOLO3** based framework to implement Single Shot Multi-box Detectors for detecting both visual and textual markers.
- Scripting a **ROS-Gazebo** based simulation to develop a SLAM based model.
- The project is aimed to build a precise **autonomous navigation system to guide visually impaired people** even in Indoor environment.

Simulation-Optimization of wireless charging station locations for electric taxis in a city
Auckland, New Zealand

RESEARCH INTERN AT UNIVERSITY OF AUCKLAND UNDER DR. ANDREA RAITH
Dec. 2020 - March 2021 (Ongoing)

- Performed **Transportation modelling** for vehicular traffic to solve **Network equilibrium problems** using **task assignment and Linear programming paradigm**.
- Performed **Discrete Event Simulation** of the taxi-rank model in Julia based simulation tool **SimJulia**.
- Added browser based visualization capabilities to the obtained model using **JavaScript-Julia** in a client-server topography.
- Performed **GIS mapping using OpenStreet Maps and Mapbox API** to develop **ML based models** to determine Speed and discharging SOC, based on terrain and locality.
- Designed the optimized city plan for localizing the charging ranks and their volume(number of induction chargers) for electric taxis in the town.
- **Incorporated the ride-sharing feature** that also allowed a taxi to plan the shortest path for picking and dropping all of the customers, using **variations of the Dijkstra algorithm**.

Graphical Machine Learning based Dark Web Analysis to predict future crime
Dept. CSIS, BITS Pilani

RESEARCH PROJECT UNDER DR. VINTI AGRAWAL
Aug. 2020 - Dec. 2020

- Developed a secure pen-drive mounted connection to the Dark Web using **I2P and TOR**.**Tails OS** was the primary OS used.
- Scripted an **automated web spider** using **Python-Selenium wrapper**, that snowballed between various Dark-web directories to extract useful data, using **CRISP-DM approach**.
- Re-developed the **Node2Vec and GraphSAGE algorithms**, using **Skip-Gram with Negative sampling** based back end, and tested the model on **IronMarch Hackforum Data**.
- Experimented with various **clustering and bootstrapping** algorithms to from groups of similar nodes.
- Successfully implemented the network's **Link prediction task using a single layer Neural Network** model to develop links between various anomalous nodes

Multi modal Biometric Facial Demographics
TechLab, STTL Ltd, India

MACHINE LEARNING RESEARCH INTERN AT TECHLAB ,SILVERTOUCH TECHNOLOGIES LTD.
May. 2020 - Aug. 2020

- Worked for developing a high accuracy Facial demographics module calibrated to work in Real-World video frames
- My tasks included experimenting with high level algorithms in **Digital Image Processing**. **SVM and Random forest** based unique hybrid en-sambled model was developed with for age regression and Gender classification.
- Developed a facial Key-point detector pipeline for emotion detection, using deep learning model based on Convolutional Neural Network and Residual blocks, using Keras with Tensorflow as a backend.
- Real world errors were reduced using measures like **PSNR and Noise - Contrast Trade-offs**.
- This model was further pipelined to be used to develop an **active learning based model to predict the Songs** based on Age and Gender features of members present in the Cafe/Bar.
- **Iot based APIs** were also developed for communicating with a media player, using the **MQTT based protocol**. **Implemented TinyML using Tensorflow-Lite** to develop a Responsible AI model.

Inspired Karters - Formula Student
Pilani, Rajasthan, India

HEAD - R&D DEPT.(EMBEDDED SYSTEM DESIGN)
Nov. 2018 - Present

- Started off with a junior engineer in 2018, got promoted to Electronics Specialist in 2019 and am currently the responsible for designing the Control and Coordination Firmware for an Electric Vehicle. I was among the **founding member of EV sub section under Inspired Karters**.
- Previously, I simulated all the Low-Voltage Electronics of the car including **safety shutdown circuits, other control circuits, and management (Battery) circuits including the pre-charge/discharge circuits using KI CAD and Multi Sim**.
- Currently, responsible for designing **Drive Control Module and Touch Screen display using STM32F412Zg MCU** and integrating the same in a **CAN controlled network**. I also developed an additional application layer protocol for tackling starvation issues.
- Working with off the shelf Data Acquisition hardware - **Kvaser Memorator** and extending its functionality by adding customized firmware for over the air updates.

Acyte Robotics - Center for Robotics and Intelligent Systems
Pilani, Rajasthan, India

TRAINEE
Aug. 2018 - Dec. 2018

- Was among the **top 10 people** who got selected for the Robotic training, from entire freshers batch of 2018, comprising of **1500+ students**.
- Did a literature review on **Inverse Kinematics, Fourier Transforms, Potential Field approach and Genetic Algorithm**.
- Built a **USB to TTL Hardware driver** from scratch. The PCB was designed on **Eagle CAD**.
- Partially designed the **CAD design of robotic arm manipulator** for a humanoid bot, having **5 DOF, on Fusion 360**.
- Developed **"Chess move verifying" module for automatic chess playing bot**, that was in the development phase.
- Implemented a Particle filter using **Hidden Markov Localization**.

Achievements

Ongoing	**Shakti Microprocessor challenge**, Shperded team Sphatik to develop Smartwearable-IoT solution on open source hardware(RISC-V), funded by Govt. of India and mentored by Dr.Pramod Tanwar, CRIS-CEERI	*Govt. India*
Ongoing	**OpenCV Spatial AI Competition**, Under Review, Funded by OpenCV and Intel	*Intel, Online*
Dec 2020	**IndiaTeck Hongkong AI for Healthcare Hackathon**, International Runners up, received a chance of incubation under Neutrinos to build up our MVP	*Online, Hong Kong*
2020	**Formula Bharat 2020 Concept Design Challenge**, International Winner	*India*
2020	**Flipkart Grid Robotics 2.0**, Part of India's top 20 teams out of 150 shortlisted	*Online*
2018	**Joint Entrance Examination(JEE)**, All India Rank 3426 among 1.6 million candidates.	*India*
2009	**The Malaysia Book of Records**, Received ORDINARY GRADE 11 in the International Standard of ABACUS COMPUTATION competition.	*Malaysia*

Relevant Projects

Advanced surveillance using Gait Prediction
IEEE Room, BPSC

OPENCV SPACIAL AI CHALLENGE
Ongoing

- Experimenting with multi-frame CNN-LSTM architecture to implement gait recognition using OAK-D stereo camera.
- Exploring the use of Depth channel to implement 3-D Neural Network model to optimize the results.

Hand Gesture Control of a Mechanical Arm
IEEE Room, BPSC

PERSONAL PROJECT
Ongoing

- Currently simulated a 6-DOF mechanical arm using ROS-Gazebo and Moveit environment.
- Used ROSSerial to publish Arduino signals.
- Used IMU and flex sensors to predict the exact orientation of the hand.

Digital and Analog VLSI design for 180 SCL Technology
Oysters VLSI Lab, BITS Pilani

DR.ANU GUPTA
Nov.2020

- A Telescopic Cascode OpAmp was designed given the Gain, UGB, Phase Margin, Slew Rate and Power Dissipation factors.
- Designed a 4 input PSEUDO NMOS NOR logic using both Differential method and Logical effort method.
- DRC, PEX and static timing analysis was performed.

Movie Review Prediction using self-built Word2vec
Data Analysis(ADAPT) Lab, BITS

COURSE PROJECT IN NATURAL LANGUAGE PROCESSING, UNDER DR.POONAM GOYAL
Nov.2020

- Designed an optimized and light-weight version of Word2Vec that converges faster and could be deployed on edge device.
- Built a movie-review recommender system using RNTN, LSTM and TfIDf approaches.
- Presented a review paper for the same.

Developing an IoT pipelining using Google Cloud Platform
GCP

SELF
Oct 2020

- Developed a complete Ingestion-Processing-Publish pipeline on GCP using the helper functions.
- Used the develop a real-time model to calculate the number of Taxis crossing a marker in New York, using open access API provided by google.

Lunar Lander Game using Reinforcement learning
MOOC by University of Alberta

REINFORCEMENT LEARNING SPECIALIZATION
Sept.2020

- Developed a Deep Reinforcement Learning model(DQN) to autonomously land a moon lander in a simulated environment.
- Implemented Neural network based action-value pair using Softmax action selection.
- Coded the Adam's optimizer for implementing the task.

Autonomous Stair Climbing Robot
Online

FLIPKART GRID ROBOTICS 2.0
July.2020

- Implemented a semi-automatic, robust robotic cart , capable of lifting 4-5 kg of weight, up and down the stairs.
- The entire control system was developed using Rasberry PI3, aided with ultrasonic sensors, RGB-D camera and motors and linear actuators.
- YoloV3 based stair detection and classification, along with centre-point localising control logic was implemented using Fuzzy PID control. The bot could sense the environment to search for stairs, and even sense accent/descent, automatically.

Data Augmentation Using GANs
Stanford Online

DEEPLEARNING.AI
Jun.2020

- Implemented image to image translation using Pix2Pix and CycleGANs, to implement data augmentation.
- Used DeepFake and DCGAN with Keras API to generate synthetic images of the trigger word detected.

Hardware Mobile Robot using Bare Metal coding on 8086
BITS Pilani

PERSONAL PROJECT
March 2020

- Designed a 4-DOF turtle bot with speed control and speed display features using Intel's 8086 microprocessor and external peripheral devices.
- Scripted the processor with Assembly directives using MASM compiler.
- Developed various other prototypes for a mobile robotic unit including a Flying Robot, Mine Exploration Bot and Garden Sprinkler bot.

Decision making for autonomous Self Driving Car Simulation model

MOOC by University of Toronto

SELF-DRIVING CAR SPECIALIZATION

May.2020

- Successfully implemented a longitudinal and lateral vehicle controller for CARLA simulator.
- Simulated the Lidar and GPS controlled ES-EKF(Error State Extended Kalman Filter) to localize the car position.
- Provided Visual perception to the car using segmented Neural networks to detect the lane and obstacles in 2-D as well as 3-D.
- Experimented with Multi-Object Tracking for a swarm of automotive systems.

Intelligent Micromouse using Genetic algorithm

IEEE STUDENT SECTION

Jan.2020

- Successfully implemented a fully automatic high speed Micromouose capable of solving the IEEE micromouse maze.
- The bot was developed using Omni wheels, Ultrasonic sound sensors,and powered by Arduino controller.
- Implemented the maze solving using modified flood fill algorithm and optimized using Genetic algorithm.
- Created a dummy software simulator using Python, for simulating the path planning algorithm.

Development of clock synchronous ALU

Digital Design Laboratory

PROJECT OF DIGITAL DESIGN UNDER PROFF. PAWAN.K AJMERA

Nov.2019

- Designed the Arthimetic Logic unit, imitating 74181 IC.
- Used basic components like shift registers, MUX-DeMUX, and basic gates.
- FSM based designed to make the unit clock synchronous.
- Verified the circuit on Verilog.

Deep Q-Learning based path follower bot using ROS-Gazebo

Apogee 2019

IEEE TECH TEAM, ML SIG HEAD

March.2019

- High Speed, auto guided vehicle with PID position control, capable of traversing a visual line embedded on the floor facilitated via RGB camera.
- A Q-Learning based, 2-layered Neural Network model was made with customized rewarding policy, to implement the model in ROS-Gazebo based simulation environment.

E-voting System using Blockchain

Online

SELF

Dec.2018

- Developed a Web based e-voting application and ran successful simulations on my self built network.
- Shifted to Etherium network using Truffle framework. The entire application was built using Node.JS.
- The application was capable of successfully conducting unhampered and unbiased elections. An additional consensus algorithm gave the results in real time.
- Developed a dummy blockchain using JAVA, following the course on Bitcoins by Princeton University.

Relevant University Courses

ELECTRONICS AND EMBEDDED SYSTEMS : Industrial Instrumentation and Process Automation, Microprocessor Interfacing, Medical Instrumentation, Control Systems, Sensors and Transducers, Digital Design, Signal analysis, Electro-Mechanical Machines, Power Electronics, Analog and Digital VLSI Design, Solid State Electronic Devices, Analog Electronics, Electrical and Electronics Circuits.

COMPUTER SCIENCE : Robotics, Computational Control System Lab, Artificial Intelligence and Intelligent Algorithms, Natural Language Processing, Computer Vision, Computer Programming, Internet of Things, OS kernel programming, Data Structures.

MATHEMATICS : Optimization Techniques and Operational Research, Probability and Statistics, Algebra and Matrices, Advance Calculus, Higher Order Differential Equations, Cryptography, Mathematical Problem Solving.

Skills

Programming languages	Python, Embedded C, C++, C#, Julia, MATLAB, Assembly language, Node.js, Bash, Latex
Platforms / Frameworks	LabView, CubeMX, Hyperledger, Unity, Keras, Tensorflow/Tensorflow-Lite, Pandas,OpenCV, ROS-Gazebo, NetworkX
HDL and EDA tools	Verilog, LTSpice, Proteus, Cadence,Microwind, NI Multi Sim, KiCAD, EagleCAD
Hardware skills	Rasberry Pi, Arduino, Xilinx FPGA, STM32 controllers, Nucelo Boards, NVIDIA Jetson Xavier NX, x86
Mechanical Design	Autodesk Fusion 360, Solidworks
Linguistic Proficiency	English, Hindi, Gujarati

Position of Responsibility

Jan. 2021	**Undergraduate Teaching Assistant**, Under Dr.Anu Gupta	*Analog IC Design*
Oct. 2020	**Embedded System Design Head**, Inspired Karter - Formula Electric	*Tech Team*
Aug. 2020	**Executive Committee Member**, IEEE STUDENT CHAPTER BITS PiLANi	*Fest coordinator*
Mar. 2020	**Treasurer**, Gurjari Association	*Cultural Association*
2019	**Member of Student Faculty Council**, Under Dr.V.K.Chaubey	*EEE Dept.*
2019	**Wing Representative**, Represented my hostel wing in the annual hostel election.	*Gandhi Bhavan.*