STATEMENT OF RESEARCH OBJECTIVE

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I believe education is a continuous process that leads us to the pinnacle of glory and transforms our society. Though there are plenty of opportunities for higher education, it is essential to set the right goal and be on the right track at the right time. Also, the key to set the goals in such a way attuning self-improvement and socially supporting with a well-defined scope and methodology. The research scope shall enhance the future technology in a constructive way and benefit the majority, work in harmony with science, environment, and humanity. Keeping such a vision and strong passion, I would like to move my academic career to the next step of knowledge, earning a Ph.D from a renowned university.

The power of intelligence and cognition makes human beings one of the unique creations in our nature. At present, humankind is moving towards an epoch of intelligent robots with learning and discussion-making abilities comparable to human beings. Artificial Intelligence (AI) is now seen as a vital technology for the development of intelligent robots. The use of artificial intelligence has enabled us to design and build robots that can adjust their behaviour according to the situation at hand. The future of robotics is even more diverse than the present. The need for AI-enabled robots will increase in the future to solve the more complex problem in industry, commercial and social fields. Hence, I focus my research interest on artificially intelligent robot design. AI involves huge data at the core for building the learning capability and performing human-like tasks using machine learning and other similar techniques. The recent advancements in embedded technology will help us build artificially intelligent robots with higher processing power and smaller footprints.

In my undergraduate studies, my interest was focused on programming. microprocessors and embedded systems were my interested domains. In my second year, I started developing an interest, particularly in embedded and digital electronics subjects. Embedded system was such an interesting course that combined my hardware and software skills to build real-time applications. In my masters, I got the opportunity to work as an embedded system design engineer in Ewings solution Trichy. It's an embedded start-up company and handled medium-scale embedded projects. In Ewings solution, I worked in the automation of vehicle trip

logging system projects. The project's objective is to develop an embedded-based vehicle tracking system using an ATMEL microcontroller, ultrasonic sensor, and MIFARE RFID. The project was developed for Maytas Infra Ltd to monitor the hired logistic vehicle used in mines and stone crushers.

e-Nose is my M.E thesis and part of Department of Science & Technology (DST) funded research project. The objective was to develop the handheld embedded system for milk and meat quality assessment. The project was developed with a low-power ATMEGA8L microcontroller and an array of Figaro gas sensors. The selected gas sensor has the capability to sense the aroma emitted from the food material. Metal oxide-based semiconductor sensors were used to develop sensor nodes. Whenever the detectable aroma/gas is found, then the sensor conductivity increases based on the chemical compound present in the aroma. A simple voltage divider electrical circuit was used to convert the change in conductivity in terms of output voltage which corresponds to the gas concentration. Further, the generated signal was amplified by simple voltage amplifier circuits and fed to the ATMEGA8L computation unit to predict milk and meat's freshness and quality.

After my master's, In 2017, I joined Chip-Crafts, an embedded systems start-up company. I worked as an embedded software developer, where I enriched my skills in embedded programming and gained good exposure for innovative product design in embedded systems. Low-cost real-time smart pump controller design was my first embedded system project in Chip Crafts. The project's objective is to help the farmers save time and optimize water and energy consumption. The smart pump controller has features, including a remote pump ON/OFF facility using SMS. The project was designed with an Arduino microcontroller and SIM800C GPRS/GSM Shield to connect the microcontroller with GSM networks. The project was developed at the cost of 6000 INR , affordable for farmers in India.

Embedded system-based automotive engine air filter degradation monitoring system is another project handled by me at Chip Crafts. This is a research project funded by TATA Motors, and the objective is to develop an air filter degradation monitoring system. Generally, automotive engines require a quality air inflow as part of their internal combustion process. In this process, air filters play a crucial role. These filters will clean the air flowing into the engine by absorbing particles that could damage the engine. After some time, the filter will become dirty and clogged, resulting in intermittent airflow that degrades the engine's performance. Besides, a clogged air filter imposes an unnecessary strain on the engine cooling system. Hence,

continuous monitoring of air filter performance is essential. Our research team developed a prototype system to monitor the air filter performance and measure the degradation level based on air delivered to the combustion process. The system was built with a remote data logger that continuously monitors the degradation level. In this project, I was involved in designing the initial prototype and using Hot Film Mass 5 (HFM5) airflow sensors, ATMEGA microcontroller, MCP2515 CAN communication module, and wireless Bluetooth transceiver for remote data logging. The stored data was used to study the variation of airflow delivered from filters in various life cycles and estimate the air filter's degradation level attached to the engine.

Another interesting project which I handle in Chip Craft is embedded system-based automotive vehicle engine testbed design. In this project, I was involved in designing the programmable electronic pedal design using an embedded system. Generally, mechanical pedals were used to control the throttle in the automotive field new engine testbed facilities. However, control throttle for different RPM using mechanical pedals is a challenging task in testing environment. To resolve this issue, we develop a programmable electronic pedal that functions as an automatic accelerator pedal and controls the throttle in the automotive field engine test environment. I accomplished this task using the ATMEGA microcontroller, which generates equal control signal to throttle using a PWM signal. Through the keyboard interface, users can configure how much acceleration they need to give new engine testing. Involvement in industry-valued projects at Chip Craft motivated me to focus my career in *social and industrial automation.*

In 2020, I started to learn AI techniques, including computer vision, machine learning, and deep learning techniques, and got a chance to work remotely with the ROAR lab - Singapore University of Technology and Design. I worked in Panthera (pavement sweeping) and hTetro (floor cleaning) robot vision system development using Deep Learning. I involved collecting an image dataset and training a deep learning framework using transfer learning techniques. Recently, my first co-author paper with ROAR lab, "Deep learning enabled self-reconfigurable robot for pavement defect and cleanliness inspection" was ***accepted in the Q1 SCI journal.*** In this article, I involved training the deep neural network using pre-trained weights and our custom dataset. Besides, a few more research articles I am currently working with in the ROAR lab include the AI-enabled vision system to sTetro robot to recognize the staircase and debris, a deep learning-based cleaning benchmark, and plant health monitoring system using deep learning computer vision and vertical robot urdella.

My interest is to develop an AI-enabled vision system for service class robots. I believe my interests, combined with my past relevant experiences and enthusiasm to work in deep learning frameworks. I am motivated and interested pursuing my PhD degree in AI enabled vision system for service class robots.