SUBMITTED TO

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INAE-SERB, DST Abdul Kalam Technology Innovation National Fellowship

IOT-BASED HYBRID ELECTRICAL VEHICLES ENERGY MANAGEMENT SYSTEMS

SUBMITTED BY

Dr. R. MANIVANNAN, M.Tech., Ph. D

Associate Professor/CSE

E.G.S PILLAY ENGINEERING COLLEGE

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SUBMITTED ON 01/02/2024

INAE-SERB, DST Abdul KalamTechnology Innovation National Fellowship

IOT-BASED HYBRID ELECTRICAL VEHICLES ENERGY MANAGEMENT SYSTEMS

1. Name of the Nominee: Dr. R. MANIVANNAN

2. Current designation and affiliation: Associate Professor, Department of CSE

E.G.S. Pillay Engineering College

3. Area of Specialization: IoT

4. Current Nationality: India

5. Date of Birth: 24/06/1985

6. Gender: Male [√] Female [ ]

~~7.~~ Category: ~~GEN~~ / OBC / ~~ST / SC~~

8. Differently abled ~~YES~~ / NO

9. Nominee' plan of work under the aegis of the INAE-SERB, DST Abdul Kalam Technology Innovation National Fellowship aimed at technology (product/process) development, prototype development, field trial, incubation of or registering a start-up company, or commercialization, if selected (within 1000 words/figures, diagrams, charts and illustrations can be included):

(a) ***Topic:***IOT-BASED HYBRID ELECTRICAL VEHICLES ENERGY MANAGEMENT SYSTEMS

(b) Objective:

The following objective to fulfil the requirement of the Underground drainage monitoring system.

- The widespread use of electric vehicles significantly strains the nation's electrical system. In-depth descriptions of the EV's energy management system (EMS) should highlight the vehicle's powertrain's vital role.
- The energy for propulsion in electric automobiles comes from a rechargeable battery. The safe and dependable operation of batteries in electric vehicles relies heavily on online surveillance and status estimations of charges.

- An Energy Management Strategy (EMS) that considers the electric vehicle's battery and ultra-capacitor may lessen the vehicle's reliance on external power sources and extend the battery's lifespan.
- A machine learning-based mathematical dynamic programming algorithm is used in designing the energy management system to teach the system how to respond appropriately to various situations without resorting to predefined rules. Therefore, this research aims to use Machine Learning to create a Smart Energy Management System for Hybrid Electrical Vehicles (SEMS-HEV) with energy storage.

(c) Motivation:

The needs of the distribution system and the detrimental impact of charging the EV are ignored. Providing energy efficiency and decreased carbon footprints under the same roof is much easier with a well-planned EMS for EVs. The primary goal of a well-designed EMS is either to maximize the use of the battery in electric vehicles or, in hybrids, to divide up the required power between the engine and the battery to reduce fuel consumption. The research of EMS for EVs and HEVs is crucial for this reason; by doing so, the different kinds of such systems can be discovered, and the benefits and drawbacks of these techniques may be extracted.

A hybrid electric car's energy management system (EMS) regulates and distributes the energy provided by the car's capacity battery pack and ultracapacitor. To maximize vehicle economy and prolong battery life, the energy management system must consider battery deterioration while providing the required power. Distributing the electricity from the power battery and ultracapacitor effectively is the primary difficulty of an energy management method for hybrid energy storage electric cars. Hotspots in the study of energy management for hybrid energy storage electric cars include the design of energy management strategy, the construction of the battery degradation model, and the matching of ultracapacitors and DC/DC converters.

(d) Methodology:

i) The workload of the HEV's engine may be managed by creating efficient EMS approaches that attempt to divide the total power needed between the combustion engine and a battery system.

ii) With the Internet of Things (IoT) and a layered computation model incorporating edge computing, this paper suggests a complete V2G connection scheduling activities framework.

iii) To guarantee the ML system's dependability and efficiency, the study provides an HEV energy management system that considers a high degree of resilience against the information regarding load inconsistency that may arise with the data provided.

iv) To that end, it has been determined whether or not the proposed SEMS-HEV can enhance HEV's EMS using dynamic programming by estimating the HEV's projected acceleration across the anticipated range.

(e) Anticipated outcome (deliverables):

This project has the following highlights,

The major objective of an integrated electrically powered vehicle is to reduce emissions and alternative energy utilization; thus, the approach used to regulate the vehicle's electrical power while in production is crucial. Thus, a dynamic programming algorithm-based management approach is provided for EVs. In addition, a double-layer architecture is used extensively in the algorithm.

(f) Timeline and milestones:

Activity/Plan	1st and 2nd Year								3rd Year			
	Phase1 (6 months)		Phase2 (6 months)			Phase 3 (12 months)			Phase 4 (6 months)		Phase 5 (6 months)	
Feasibility Study & Data Collection												
Equipment Requirements												
Installation of Equipment on 1st Purchase												
Testing the Working Condition												
Result & Analysis Phase												
Installation of Equipment on 2nd Purchase												
Testing the Working Condition												
Result & Analysis Phase with actual test data												
Complete setup Installation and Operation												
Development Phase												
Test Data and Debugging												
Final Analysis and Delivery												

(g) Novelty of outcome:

Yes. Pleasure strategies for managing vehicles often behave significantly in ideal and real-world settings. Since the instructional information set lacks all driving scenarios, the learned control approach is the sole option for properly managing the battery-operated rechargeable vehicle's battery power. Since test scenarios might vary greatly, the algorithm's influence on non-testing conditions will also vary.

10. Briefly describe the work completed or being perused by the candidate within 500 words/ figures, diagrams, charts and illustrations can be included*(candidate's work may have shown a significant impact on health sector/ engineering /agriculture by his/her findings, a clear statement is required to explain of whether any incubation, startup, technology demonstration and technology development has emerged from the candidate's contribution.):*

(a) Novelty and relevance of the research innovation achieved:

The coordinating component of an EV receives the customer's device's charge metrics in real moments and uses them to ascertain its battery SoC modification. As peripherals, coordination networks help reduce latency for the SoC change computing tackle while alleviating the burden on the cloud. However, the cloud server schedules V2G operations.

(b) ***Science and Engineering concept involved in the proposed technology:***

Direct current power is generated by fuel cells by an electromechanical mechanism similar to a battery's. This prevents combustion and the environmental damage it causes. Fuel cell generators are gainingpopularity due to their high power density and low carbon footprint.However, it also stands out because of its high efficiency, flexible fuelsources, and waste heat recycling capabilities. Energy is produced in theproposed project through an insulating fuel cell. To get an outputvoltage of about 120 V with no load, a single fuel cell system, rated at24 V, is connected to the DC bus.

(c) Contribution of the nominee in the proposal:

The three primary players in this system are the Independence Systems Operation (ISO), the buyers and consumers of electric vehicles(EVs), and the owners and operators of EV charging stations. Keepingthe electricity flowing to businesses and homes in the area is under thepurview of the local grid system operator, or ISO. The ISO often offersdynamic electricity pricing to promote end-user participation indemand-side energy management, alleviate the power demand strain,and decrease distribution maintenance expenses. Electric vehicles areprime candidates for participation in the energy market since they aremore amenable to schedule and charging capacity regulation thantypical home appliances.

(d) Interest to society/market:

Industrial Usage: Its low cost or cost effective, user friendly and portable mechanism is the need of the hour

11. Technology development, contribution and its status and significance (within 500 words/ figures, diagrams, charts and illustrations can be included):

Ready for / further work needed in one or more of the following:-

- Incubation of a technology company/ Creation of Start-up and any Technology demonstration (outline individual contribution): Start-up facility can created based on location and building smart cities
- Patent filed or commercialized – IPR and Patenting
- Building Smart Development and Cities

12. Contact Address:

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Email: maniramanatha@egspec.org

13. Educational Qualifications (from Bachelor degree onwards)

S.No.	Degree	University	Year	Subjects	Percentage/GPA
01	B.E	Anna University	2006	ECE	63%
02	M.Tech	SASTRA University	2009	CSE	6.90
03	Ph.D	Anna University	2017	ICE	-

14. Details of professional training and research experience:

S.No.	Place of Training	Position	Period	Country
-	-	-	-	-

15. Details of employment/position held in last 10 years:

S.No.	Employed at	Position	Period (From-To)	Country
01	E.G.S. Pillay Engineering College	Associate Professor	Jan-2020 to Till date	India
02	E.G.S. Pillay Engineering College	Assistant Professor	December-2009 to Jan - 2020	India

16. Professional awards/recognition/fellowship (e.g. Swarnjayanti/Bhatnagar Prize, Fellow of INAE, INSA etc.):

S.No.	Name	Year	Donor organization	
-	-	-	-	-

17. List of peer reviewed publications in last 5 years(authors, journal, reference) with impact factor (as per JCR) :

1. R. Manivannan, “Research on IoT-based hybrid electrical vehicles energy management

2. systems using machine learning-based algorithm”, Sustainable Computing: Informatics and Systems, https://doi.org/10.1016/j.suscom.2023.100943

3. K. Manikandakumaran, R. Manivannan, Kalaiselvi S, Anitha Elavarasi S, “An IoT based environment conscious green score meter towards smart sustainable cities” published in international Journal of Sustainable Computing: Informatics and Systems on Jan 2023 by Elsevier publications (ISSN: 2210-5379), Vol 37, 100839, PP 1 – 13.

4. R. Manivannan, A. FairoseBanu, M. Sameera Banu, S. ThahlemaBanu, " Human Authentication System Using Multimodal Biometrics" published in International Research Journal of Modernization in Engineering Technology and Science on April 2021 by IRJMETS publications (ISSN: 2582-5208), Vol 3, Issue 4, pp 1595 – 1599.

5. R. Manivannan ,M.Chinnadurai "Analysis of energy efficient and network Traffic delay in wireless Networks using channel aware routing" published in International journal of Transactions on Emerging Telecommunications Technologies on Dec 2020 by John Wiley & sons, Ltd Publications (DOI: 10.1002/ett.4089) Vol 31, No 12, pp 1-9.

6. R. Manivannan ,M.Chinnadurai "An efficient protocol for power consumption in wireless enterprise ad hoc virtual community network with Triso framework " published in International journal of Enterprise Network Management on 2018 by Inderscience Enterprises Ltd Publications (DOI: 10.1504/IJENM.2018.094656) Vol 9, No 3/4, pp 317 - 332.

7. R. Manivannan , K. Balasubramanian & S. Praveen Kumar, "Finding Location Using Box Query Algorithm Over Moving Object" published in the South Asian Journal of Engineering Science & Technology on April 2017 by SAJREST Publications (ISSN: 2455 - 9261), Vol 2, Issue 2, pp 554 - 561.

8. R. Manivannan , Srilekha K, Ranjitha N, Sairam Shalini R, "Vehicle Parking Place Finder Using Distance Optimization" published in the International Journal of Engineering Science & Research Technology on March 2017 by IJESRT Publications (ISSN: 2277 - 9655), Vol 6, Issue 3, pp 256 - 262.

9. R. Manivannan , M. Chinnadurai, "Low Latency Anonymity detection & Prevention Using Diversity Mix Techniques " published in the International Journal of Printing, Packaging & Allied Science on Feb 2017 by IJPPAS Publications (ISSN: 2320 - 4387), Vol 5, Issue 1, pp 930 - 944.

10. R. Manivannan , S. Arul Sathya & R. Satheesh Kumar, "Optimal Delay anonymity Tradeoff in Wireless Network" published in the International Journal of Computer Science & Engineering on March 2016 by SSRG Publications (ISSN: 2348 - 8387), Vol 3, Issue 3, pp 17 - 21.

11. R. Manivannan & Dr. S. Titus, "Multiparty Control for Online Social Network" published in the International Journal of Applied Engineering Research on July 2015 by Research India Publications (ISSN: 0973 - 4562), Vol 10, Issue 51, pp 86 - 88.

18. Details and status of patents filed/accepted and commercialized(International, National):

Published: 02

E.G.S. PILLAY ENGINEERING COLLEGE (Autonomous)
Nagapattinam - 611 002, Tamilnadu, India.
Provisionally Accredited by NBA (CSE, EEE, Mech, IT, ECE, Civil)
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Endorsement Certificate Format for the INAE-SERB, DST Abdul Kalam Technology Innovation National Fellowship

1. Certified that the University/Institute welcomes participation of Dr. R.MANIVANNAN as Abdul Kalam Technology Innovation National fellow.

2. Certified that necessary R&D, administrative and financial support will be extended to him/her for research as per the terms and conditions of the grant throughout the duration of the fellowship.

3. Dr. R. MANIVANNAN is working as Associate Professor in the institute and engaged in research. He is holding the position till date. The financial papers (statement of expenditure and utilization certificate) of his/her fellowship will be sent to INAE after the completion of each financial year.

4. Dr. R. MANIVANNAN is not availing any other fellowship.

Signature of the Head of the Institute/University with seal

Dr. S. RAMABALAN, M.E., Ph.D.,
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Date: 01/02/2024
Place: Nagapattinam