SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY,KARUKUTTY				
Grants received from Government and non-governmental agencies for research projects / endowments in the institution during the last five years (INR in Lakhs)				
ACADEMIC YEAR MAY 2021-JUNE 2022				
SL NO:	Faculty Name	Department	Sanctioned by	Sanctioned amount
1	Ms. Remya Y K	Civil Engineering	CERD_KTU	120000
2	Vinoj P G	ECE	CERD_KTU	75000
3	Hazel Elza John	ECE	KSCSTE	9800
4	Rosebell	CSE	APJKTU CERD Student Seed Money	49,860
5	Deepasree varma	CSE	SERB DST	1,664,000
TOTAL SANCTIONED AMOUNT 2021-2022				1918660

PRINCIPAL
SCMS SCHOOL OF ENGINEERING & TECHNOLOGY
VIDYANAGAR, PALLISSERY, KARUKUTTY
ERNAKULAM, KERALA-683 576

Dr Venkatakrishnan Balasubramanian
21 Vaughan Chase
Wyndham Vale 3024 VIC

15 March 2021

Dear Dr Balasubramanian,

Re: Regional Collaborations Programme COVID-19 Digital Grants

I am pleased to inform you that your application for the Regional Collaborations Programme COVID-19 Digital Grants has been approved by the Department of Industry, Science, Energy and Resources.

A single invoice for $10,000 (GST exclusive) should be submitted by your organisation to the Academy before 1 May 2021. Please note that grant funds can only be used for expenses as outlined in the proposal titled "Artificial Intelligent based alarm to predict the sudden deterioration of health in COVID-19 patients". Any changes to budget allocations must be approved in writing by the Academy.

We remind you that under the Regional Collaborations Programme COVID-19 Digital Grants, researchers must complete projects by 31 January 2022 and there is no capacity to extend this deadline.

It is a condition of your award that you submit a progress report and a final report to the Academy. All reports will be provided to the Department of Industry, Science, Energy and Resources by the Academy. The report templates will be sent to you by 1 May 2021, with a progress report due by 1 June 2021 and a final report due by 31 March 2022.

It is a requirement that any scientific or media publications resulting from the project funded by this program mentions the support granted to the project by the Australian Academy of Science and the Department of Industry, Science, Energy and Resources.

If you have any concerns or questions regarding the grant, please do not hesitate to contact me.

With best wishes,

Nancy Pritchard
Director International Programs and Awards
Email   grants@science.org.au
☎   (02) 6201 9412

AUSTRALIAN ACADEMY OF SCIENCES

Regional Collaborations Programme COVID-19 Digital Grants

Project Title: Artificial Intelligent based alarm to predict the sudden deterioration of health in COVID-19 patients

Project Members: Dr. Venki Balasubramian, School of Science, Engineering and Information Technology, Federation University, Mount Helen VIC 3350, Australia

Dr. Varun G Menon, SCMS School of Engineering and Technology, Ernakulam, Kerala, India 683544.

Grant Amount: 10,000 USD

Outline the project and discuss how the project directly or indirectly contributes to the response to or recovery from the COVID-19 pandemic in the Asia-Pacific region.

Problem Statement: Coronavirus disease (COVID-19) is a transferable illness that has infected millions of people, as of December 2020, there have been over 65.8 million cases and over 1.5 million deaths reported since the start of the pandemic in Wuhan, China, in December 2019 [1]. Due to this, the current COVID-19 pandemic has imposed significant stress on medical facilities on world countries and no country have envisioned such a need during the early stage of the pandemic. The lack of medical facilities has adversely threatened the quality of COVID-19 patient care monitoring in the hospitals for world countries.

Proposed Solution: Remote monitoring offers the opportunity to carefully monitor confirmed or suspected COVID-19 cases from isolated place or at home with minimal clinician intervention. Remote monitoring also allows for the timely identification of worsening symptoms through intelligent predictive alarms. The project will develop an Artificial Intelligent (AI)-based alarm that can predict the sudden deterioration of health due to COVID-19 disease by deploying a remote continuous monitoring setup using Internet of Medical Things (IoMT) that will stream data from a range of biophysical markers to Cloud.

Background: Remote isolated monitoring using IoMT helps to reduce the workload and the risk to the healthcare workers in hospitals. Additionally, it may decrease the number of hospital visits and admissions during COVID-19 times, thereby reducing the use of scarce resources, optimizing health care capacity, and minimizing the risk of viral transmission. Continuous monitoring show lower mortality rates in Jiangsu province, China, where an early warning system based on monitoring of respiratory rate (>30bpm), SpO2 (<93%) and heart rate (>120bpm) was deployed. A cure rate of 96.67% was attributed to the early warning system [2]. During this pandemic, the Department of Health and Human Services in Victoria, Australia recommends elderly patients in residential care facilities be monitored 4/24 for temperature (>38.5), persistent tachycardia, respiratory rate (>30 bpm), BP (< 90 mmHg systolic, < 60 diastolic) and SpO2 (< 90%) in the isolated room to detect any risk of sudden health deterioration [3].

However, an effective deployment of remote isolated monitoring depends heavy on the generation of smart alarms. Studies have demonstrated that the generation of smart alarms during the monitoring of patients is critical for the early detection of deterioration in patients' health that leads to proactive treatments to reduce the risk of mortality considerably [4]. Although a considerable number of existing methods identified in the literature for clinical alarm generation, they typically raise alarms depending on the pre-set values results in frequent alarms and not designed for current COVID-19 monitoring. In most cases, the majority of these alarms are non-actionable because they may have crossed the pre-set parameter limits but have minimal clinical significance – these alarms are knowns as false positives or simply known as false alarms [5]. Due to frequent false alarms, clinicians become less sensitive towards patients' alarms, and neglect any possible dangerous situations resulting in "alarm fatigue" at times [4,5]. In the current pandemic situation, the frequent false alarms are more dangerous because it requires frequent manual intervention of clinicians that might risk their safety and any negligence of alarms by clinicians cause sudden deterioration in patients' health or even death. The main focus of the project is to design and implement clinical alarms for confirmed or suspected COVID-19 cases that is triggered 'right on time' and accurate so that treatment can be started promptly.

Project Description: According to World Health Organisation, most people with COVID-19 develop only mild (40%) or moderate (40%) disease, approximately 15% develop severe disease that requires oxygen support, and 5% have critical disease with other medical complications [6]. The project will establish a trial in India for data collection and a novel artificial intelligence algorithm will be developed in collaboration by following the below activities:

1. The project will commence in April 2021. In the first 2 months, a pilot monitoring of suspected or confirmed mild COVID-19 patients will be established in India with an existing remote monitoring kit.
2. The pilot will have the implementation of the software to automate data collection, embed the pre-set algorithms with the baseline value as recommended in [6] (respiratory rate > 30 breaths/min, SpO2 < 90% and temperature > 38.5°C), and generate reports.
3. The lead CI Balasubramanian have immense expertise in real-time data streams from IoMT work along with the Indian CI Menon to design and develop an AI-based algorithm to raise an alarm.
4. A novel AI-based predictive algorithm will be developed with the machine learning inferred COVID-19 risk predictions along with the vital signs collected from samples in 1 and 2.
5. The novel AI-based algorithms will be used to predict COVID-19 by setting up extended monitoring in India with confirmed moderate COVID-19 patients. Thereby building up a unique dataset for AI training and performing a much-needed public health service to raise 'right on time' alarm for deteriorating COVID-19 patients.
6. The last one month will be devoted to the write-up of papers, analyzing quantitative and qualitative data collected during the trials.

While India has strictly imposed lockdown rules to avoid the spread of COVID-19 they have had to relax the rules to sustain her economy. The spread of COVID-19 is inevitable but

minimising the number of deaths is possible by monitoring suspected or confirmed COVID-19 cases at home or for those in isolation. The current pandemic has overburdened the Indian government hospital setup and the community considerably, the average cost of a hospital bed per day for COVID-19 monitoring in India is reported to be 150 AUD compared to the average salary of 70% of Indians is less than 200 AUD per month. The existing healthcare setup requires novel, alternative COVID-19 monitoring opportunities with early smart intervention. The deployed remote monitoring with AI-based alarms can influence the clinicians to shift the patients to hospitals only based on their deteriorating health condition and can drastically reduce the hospitalization cost not only in India but in the growing economic countries across Asia-Pacific region.

Project Team: CI Balasubramanian has expertise in the development of a scalable IoT architecture for the secure transmission of IoMT data that led to the Anidra spin-out he founded. CI Menon has expertise in IoMT, genetic algorithms, machine learning techniques and mobile health applications. The CIs have already established collaborations through joint publications and clinical approval/development of a smart, remote patient monitoring in Australia and in India. The CI Balasubramanian has applied the IoMT architecture to remote vital signs monitoring in one of the private hospitals in India with AI-based early warning scores. Both Australian and Indian CIs have the right combination of expertise ranging from IoMT, Cloud and AI to complete the project. The team have established clinical partners in India to carry out the trial. The Project funds will be used to develop code to train the AI algorithms and for the cloud infrastructure for the project.

References:

1. WHO, 'COVID-19 Weekly Epidemiological Update', 2020. [Online]. Available: https://www.who.int/publications/m/item/weekly-epidemiological-update-8-december-2020. [Accessed: 8- Dec- 2020].
2. Sun Q, Qiu H, Huang M, Yang Y. Lower mortality of COVID-19 by early recognition and intervention: experience from Jiangsu Province. Ann Intensive Care. 2020 Mar 18;10(1):33. doi: 10.1186/s13613-020-00650-2. PMID: 32189136; PMCID: PMC7080931.
3. State Government of Victoria. (2020). [Online]. Available: https://www.dhhs.vic.gov.au/aged-care-sector-coronavirus-disease-covid-19. [Accessed: 6- Dec- 2020].
4. Bell, L., Monitor alarm fatigue. American Journal of Critical Care, 2010. 19(1): p. 38.
5. Christensen, M., et al., Alarm setting for the critically ill patient: a descriptive pilot survey of nurses' perceptions of current practice in an Australian Regional Critical Care Unit. Intensive and Critical Care Nursing, 2014. 30(4): p. 204-10.
6. WHO, 'Clinical management of COVID-19', 2020. [Online]. Available: https://www.who.int/publications/i/item/clinical-management-of-covid-19. [Accessed: 6- Dec- 2020].

Describe how the activity will contribute to building linkages in the Asia-Pacific region, and facilitate greater science, research, and innovation collaboration. *No more than 300 words*

In India, the majority of people in the rural region cannot readily access health check-ups as primary care in most villages are established to give only firsthand medical attention. More than 46% of patients travel over 100 kilometres from small towns to metropolitan areas to seek proper secondary care facilities. While in Australia, around 37% of the population live outside the capital cities and the major metropolitan centers. Indeed about 2.8 million people live in settlements with a population of less than 1000. On average, Australians living in rural and remote areas have shorter lives, higher levels of disease, and inadequate access to and use of health services, compared to people living in metropolitan areas. The provision of COVID-19 disease monitoring in these highly dispersed populations (in Australia) and highly dense populations (in India) is a significant challenge. The deployed remote monitoring clinics with AI-based smart alarms would have immense potential to influence the entire set up of the healthcare system in both countries.

There is evidence in Australia that the general public will engage in using remote monitoring for mild to moderate COVID-19 diseases show they can be managed in the community. However, these patients are kept track using a mobile application that asks them to self-report their symptoms each day. The report is fed into a dashboard monitored by the practice's nurses, who can see whether individual patients are stable or if their symptoms are getting worse and they need to be contacted. The research of AI-based smart alarms to predict the worsening condition of COVID-19 patients will facilitate greater science by automating the detection process with minimal human intervention. The innovation will contribute in building linkage by reducing the hospitalization cost not only for India but also with the developing economy countries in Asia-Pacific region.

Describe how intellectual property (IP) may be used and managed in your project and any proposed ownership of IP resulting from the project will be managed. *No more than 300 words*

It has been agreed that all background intellectual property (IP) will be owned by the respective parties and the new foreground IP will be shared according to respective monitored contributions from partners. Any extension made to partners background IP (by any partner) will be owned by its original IP contributing partner.

Agreements will be reached amongst partners prior to commencement so that background IP is retained by each partner and commercialization of IP developed during the project is shared on the basis of contribution. Wherever possible IP will remain accessible for the public good.

AUSTRALIAN PROJECT MANAGER

Contact details

Title Dr

First name Venkatakrishnan

Last name Balasubramanian

Gender Male

Birthdate 1978-01-24

Email address v.balasubramanian@federation.edu.au

Phone number

Please enter at least one phone number

Mobile phone 0430474599

Home phone

Work phone 03 53276407

Postal address

Street 21 Vaughan Chase

City Wyndham Vale

Postcode 3024

State VIC

Country Australia

University or organisation Federation University Australia

Date of PhD conferral 2012-11-22

CAREER INTERRUPTIONS

Has your career been interrupted? No

PROJECT DETAILS

Field of Science Information and computing sciences

Field of research (no more than 10 words) Body Sensors, Cloud, Networks, Artificial Intelligence & Health Informatics

Duration of project

Proposed start date 2021-04-01
Proposed end date 2021-10-31
Project title (No more than 15 words)

Artificial Intelligent based alarm to predict the sudden deterioration of health in COVID-19 patients

What is the predominant activity progressed by the funding? Developing code

Amount of digital grant funding requested (up to A$10,000) 10000

Project total value, including in-kind contributions

Cash value 0

In-kind value 16,970

Total value (cash + in-kind) 26,970

PARTNER DETAILS AND CONTRIBUTIONS 1

Partner economy India

Partner organisation SCMS School of Engineering & Technology, Palissery, Karukutty, Kerala 683576, India

Researcher/business partner's name Varun G Menon

Research/business partner gender Male

Cash contribution 0

In-kind contribution 1,840

Other contributions to the collaboration (eg. financial, research infrastructure, unique data, expertise) (No more than 50 words)

Both Australian and Indian researchers working on the proposed field of expertise for longer time – they will source the required body sensors for the trial and the data collection. The Indian partner also provide the required hospital and clinical expertise through their past collaboration.

PARTNER DETAILS AND CONTRIBUTIONS 2

Partner economy

Partner organisation

Researcher/business partner's name

Research/business partner gender

Cash contribution

In-kind contribution

Other contributions to the collaboration (eg. financial, research infrastructure, unique data, expertise) (No more than 50 words)

SCMS SCHOOL OF ENGINEERING & TECHNOLOGY

Accredited by NAAC, Affiliated to APJ Abdul Kalam Technological University, Kerala and Approved by AICTE, Govt. of India
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CAMPUS: VIDYA NAGAR, KARUKUTTY, ERNAKULAM-683576 PHONE: 0484- 2882900, 2450330
E-mail: sset@scmsgroup.org • Website: www.scmsgroup.org/sset

11th December, 2020

Reg: Regional Collaborations Programme COVID-19 digital grants

This letter confirms my commitment to participate in the delivery of the project titled "Artificial Intelligent based alarm to predict the sudden deterioration of health in COVID-19 patients" under the Regional Collaborations Programme COVID-19 digital grants.

Subject to the project proposal being funded by the Regional Collaborations Programme COVID-19 digital grants, I confirm that I will contribute to the project and relevant activities as indicated in the project proposal. I will also provide organisational resources to conduct the clinical trial in India for 3 months.

My contribution will include:

1. An in-kind contribution of Rs 92,000 towards 2 hours per week for seven months.
2. Preparation and approval of Ethics application from Ethics committee to conduct the trial in India.

Sincerely yours,

Dr. Varun G Menon, *Senior Member IEEE, ACM Distinguished Speaker*
Associate Professor and Head
Department of Computer Science and Engineering
International Collaborations -in charge
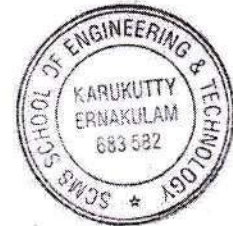
भारतीय सूचना प्रौद्योगिकी संस्थान कोटा
INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTA
2nd Floor, Prabha Bhawan, MNIT Campus, JLN Marg, Jaipur -302017
Ph: 0141-2715071, E-Mail: office@iiitkota.ac.in

No: IIITK/2021-22/R&D/4073   Date: February 18, 2022

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Dr. Deepasree Varma** is Co-Principal Investigator in the project entitled "Cross-lingual knowledge transfer for social media analysis in less-resourced languages during COVID-19", which is approved by the Department of Science & Technology (International Bilateral Co-operation Division) under the scheme India-Slovenia Bilateral Scientific and Technological Cooperation, Government of India. The file number is DST/ICD/Slovenia/P-15/2021 (TPN: 55580). The cost of the project is Rs.16,64,640/- for a duration of three years.

Please feel free to contact me for any further information at basant.cse@iiitkota.ac.in

Dr. Basant Agarwal,
Principal Investigator,
Assistant Professor, IIIT Kota

File Ref.No.KTU/RESEARCH5/467/2022

APJ Abdul Kalam Technological University
Thiruvananthapuram

Abstract

APJAKTU - Financial Assistance to Student Projects 2022 - Administrative Sanction accorded - Orders issued.

RESEARCH SECTION	
U.O.No. 964/2022/KTU	Thiruvananthapuram, Dated: 27.04.2022

Read:-1. Minutes of the 1st meeting of Engineering Research Council dated 27.01.2010.
2. Minutes of 2nd meeting of Executive Committee dated 21.10.2010.
3. Meeting of the 2nd Research Council dated 29.02.2017.
4. Proposals of Student Projects for Financial Assistance.
5. Screening Committee meeting held on March/April 2022 for evaluation of project proposals.

ORDER

Vide paper read 1st above, the Engineering Research Council had approved the scheme for Financial Assistance to Student Projects for the Government Engineering Colleges. Vide paper read 2nd above, it was decided to extend the financial assistance to the student projects to the students of the Government aided and Government Controlled Engineering Colleges.

It was decided to extend the financial assistance to Student Projects for all engineering colleges affiliated to the University with NBA accreditation as per paper read 3rd above. It was also decided that the financial assistance will be provided as reimbursement of expenditure occurred for the sanctioned project.

The Screening Committee meetings held in March/April 2022 evaluated the project proposals forwarded from Engineering Colleges affiliated to the University and recommended financial assistance to selected proposals as per the List appended.

Administrative sanction is therefore accorded for financial assistance to student project as detailed in the list attached below. The project shall be completed within a period of 1 year and the project shall be completed with the students who presented the project before the Screening Committee.

The expenditure should be incurred as per the terms and conditions as per Annexure II attached. The amount will be reimbursed to the Principal of the concerned Colleges only after the successful completion of the project and on the production of certified bills & vouchers along with the audited utilization certificate, statement of expenditure and project completion report.

The expenditure shall be met from the Head of Account "S 3022-Innovative Student Project".

Orders are issued accordingly.

Sd/-

Dr. Shalij P.R *
DEAN (Research)

Copy to:-
1. Principals of Engineering Colleges.
2. Principal Investigators.

Sl No	Name of Princpal Investigator	Name of Student Investigators	Title of the Project	College	Consumables	Equipments	Travel	Contingency	Others	Amount sanctioned	DEPARTMENT
1	Lalu V Assistant Professor	Aparna E Divya G Meera S M Harinl	Automated Vacuun Cleaner	College of Engineering Trivandrum	2000	15,000		1000		18,000	ECE
2	Sindhu N Associate Professor	Abhirami G S Lasitha E Rigzin Dolma Sezna Bijumon	Negative emotion alert system	College of Engineering Trivandrum	3500	6000		2500		12,000	ECE
3	Jisha VR Associate Professor	Ashna Nizam Aysha S Hasna M Rafi Rosemary Mathew	Design and development of a pond cleaning robot	College of Engineering Trivandrum	5000	27,500	1000	1000		34,500	EEE
4	Yashida Nadir Associate Professor	Swaliha PC Vybhav A Nambiar Vishnupriya ES Shehina SS	Tensile,Bond strength properties of FRCM,AND ITS Strengthening effects on Structural Elements	College of Engineering Trivandrum.	8000	21,500	1000	4000 (Labour charges (5500))		40,000	CIVIL
5	Lea Mathew Associate Professor	Govind Jayakumar Abhirami P Aswana B Saurav Purushothaman	Prevalence of microplastics in table salt, sea water and beach sands of Trivandrum city	College of Engineering Trivandrum.	7000	25,000	2500	3800		38,300	CIVIL
6	Sidharthan S Assistant Professor	Abin Krishna V S Cherian G Kazhunnady Davis James Girinath P A	Design and development of an automated system for assisting agriculture	RIT Kottayam	10,000	30,000		10,000		50,000	MECH
7	Dr. Upama Rajan M N Assistant Professor	Aparna A Ajith Jayan Ashly C. Dhanu Sidharth S	IOT based SMART IRRIGATION SYSTEM	RIT Kottayam	5000	15,000		2000		22,000	ECE
8	Dr. Manu V Thottakkad Assistant Professor	Abhijith P V Chithran K S	Property Evaluation of Nano Grease Produced from Vegetable Oil	Government Engineering College Kozhikode	10,000	20,000	5000	15,000		50,000	MECH
9	Sreejith S Assistant Professor	Akshay Dinesh Harshad T Anaz Moideen Sivadas Athulraj V K	Agribot(Agriculture Robot)	Government Engineering College Kozhikode	5000	7000		1000		13,000	ECE
10	Dr. Bindima T Assistant Professor Co-Investigator Titto Anujan Assistant Professor	P V Vivek Kumar Hithesh Kumar K.A K Yadukrishnan Melvin Manuval Alestin Chummar	Gesture - controlled Augmentative and Alternative Communication Device	Government Engineering College Kozhikode	5000	10,000		2000		17,000	ECE
11	Dr. Abdu Rahman V Assistant Professor	Megha T P Reshma N Merin Thresia T Shilpa Unni	IoT based public vehicle tracking system	Government Engineering College Kozhikode	5000	7000		1000 (Expenses for fabrication of the prototype-1000)		14,000	ECE
12	Jinu Jayachandran Assistant Professor	Aslam E K Asif Sartaj Mohammed Adil Ashraf Mohammed rameesh CV	Smart Class room	GEC Wayanad		6500	500	500		7500	ECE

No	Faculty	Students	Project Title	College						Total	Dept
13	Prof. Anas.M Assistant Professor	Arya Suresh Nithu Raveendran Jesin Vengilatt Muhammed Shahid .K	Underwater Drone	Government Engineering College Wayanad	4000	20,000	2500	2500		29,000	ECE
14	Dr. Aji Joy Associate Professor	Sruthi G Panicker Ijaz E Ephraim Mathai	Design of a swam of drones for courier service.	Mar Athanasius College of Engineering, Kothamangalam,	5000	18,000		2500		25,500	ECE
15	Geethu James AssistantProfessor	Akshay Johnson C Amrutha Jerin George Munna Mani	Landslide detection and warning system	Mar Athanasius College of Engineering Kothamangalam	5000	25,000	2000	2000		34,000	EEE
16	Ninu Joy Assistant Professor	Abhishek Mohan Adwaith S Alfiya Subair Anto Jose	Performance analysis of a complete EV powerstrain using a microcontroller and Matlab simulink	Mar Athanasius College of Engineering Kothamangalam	1000	18,000	1000	1000		21,000	EEE
17	Dr. Elizabeth Isaac Assistant Professor	Anju C A Jesvin Varghese Labeeb E V	Wearable hand device for sign language prediction and audio output.	Mar Athanasius College of Engineering, Kothamangalam,	500	20,000				20,500	CSE
18	Mohamed Shahid P. A Assistant Professor	Sreekanth M. Midhun Murali Abhinand A. Nandu Mohan	DESIGN OF A 2 DOFS DRIVING MECHANISM FOR A MOTION ASSISTED FINGER EXOSKELETON	TKM College of Engineering,Kollam	10,000		5000	15,000		30,000	MECH
19	Jyothis R Assistant Professor	Vishnu B Vinod Abel S Varghese Divya T P Akshay Kannan	Robotic Doctor	TKM College of Engineering, Kollam	5000	25,000		3000		33,000	ECE
20	Shafi M N Assistant Professor	Vipin Krishna V Krishnanunny.S Rajasree.S Fathima.A	Multipurpose Hybrid VTOL UAVs	TKM College of Engineering, Kollam	2000	30,000				32,000	ECE
21	Dr. Nissan Kunju Assistant Professor	Agilezuevy K.R Shravana A.J Shahina S Devapriya J.	Design and Implementation of a cost-effective portable Electrical neuromuscular Stimulator.	TKM College of Engineering, Kollam	2500	4500		500		7500	ECE
22	Prof. Amina N Assistant Professor	Anagha M Das Akhila Raveendran Mohammed Jaris J Neethu K	IoT empowered smart farming	TKM College of Engineering,Kollam-		6000		1000		7000	ECE
23	Dr. Mathew P Abraham Assistant Professor	Bharat Vinod Binitha Merlin Philip Emil Roy Navami Dilee	Design and Development of Inverted Pendulum Balancing Drone	TKM College of Engineering, Karicode	1000	40,000	1000	2500		44,500	EEE
24	Dr. Mohammed Mansoor O Assistant Professor	Anandu Ajayan Ajay Babu Anilbabu Athul Krishnan Nevin Binu	Low Cost Electronically Commutated Mixer Grinder	TKM College of Engineering, Karicode	3000	32,000	2000	3000		40,000	EEE
25	Dr. Priya K. L Assistant Professor	Gayathri H Gowtham Mohan Gopika Sankar M S Sreelekshmi S	Tidal and physico-chemical effects on the distribution of chlorophyll-a in the Ashtamudi estuary, India and Chikugo estuary, Japan	TKM College of Engineering Kollam	10,000	25,000	10,000	5,000		50,000	CIVIL
26	Dr. Priya K. L Assistant Professor	Abhijith R Nair Abhinand A S Vikhnesh C R Vishnu Rai	A coupled RSGIS-Fuzzy Logic Model for Evaluation of Eutrophication Status of Freshwater Lakes	TKM College of Engineering Kollam	10,000	30,000	5000	5000		50,000	CIVIL

No	Name / Designation	Team Members	Project Title	College	Col1	Col2	Col3	Col4	Col5	Total	Department
27	Femina A Associate Professor	Ansi AS Devipriya Mudiyil Hina Mol Yadu Krishnan V	Removal of Heavy Metal from Water using Agro-waste	TKM College of Engineering, Kollam.	3000	10,000	1000	1000 (10,000/- for analysis)		25,000	CHEMICAL/BIOTECH
28	Dr.Habeeb Muhammed MA Assistant Professor	Anitha Jose Joseph Martin Parvathy Santhosh Bhadran Vishnu Sahadev	Fabrication of NIR luminescent gols nanocluster NIR Plasmonic Copper Sulphide nanoparticle hybrid for bioapplications	TKM College of Engineering Kollam	10,000	33,000	2000	5000		50,000	CHEMICAL/BIOTECH
29	Prof. Nikhil Binoy C Associate Professor	Sreeja Balaji Vismaya K Jinsha C	Detection of Pipeline Crack and Clog detection Robot using Convolutional Neural Network.	NSS College of Engineering NSS Nagar, Akathethara, Palakkad.	2000	5000		500		7500	ECE
30	KEERTHI KRISHNAN K Assistant Professor	Abhishek.A Govind Vijayan Vishnu Nismi PT	Smart Assistance Glove with Gesture Recognition.	NSS College of Engineering NSS Nagar, Akathethara, Palakkad	2500	3500		1500		7500	ECE
31	Dr.MayaMohan AssociateProfessorand Head	AmalRosh AnolJoseph C Vyshanv Prasanth SouravMenon	Intrusion Detection in Home loT Network Using Deep Learning.	NSS College of Engineering NSS Nagar, Akathethara, Palakkad,	3400	13,800		1500		18,700	CSE
32	Soja Salim Assistant Professor	S Aravind P Lakshmi Sara Sulthana Shaji	Satellite Imagery to map translation	SCT College of Engineering, Pappanamcode				5000		5000	CSE
33	Dr. Soniya B Professor	Sukanya M V Arun T Jose Aarcha J R	Multimodal FakeNews Detection using hybrid RNN-CNN approach	SCT College of Engineering. Pappanamcode		50000 (for purchase of GPU)				50,000	CSE
34	Biju Jacob Assistant Professor	Albin L Vinod Aswathy p Chandran Manya Madhu.B Naveen Antony	Comparitive Study of Methods for restoration of biological soil crust in ecosystems disturbed by excessive surface runoff	Sree Chitra Thirunal College of Engineering Pappanamcode	10,000	30,000	2000	5000		47,000	CHEMICAL/BIOTECH
35	Smt Gayathri V Assistant Professor	Devi Krishna Diya Sharma Jeswin Elizabeth James Navaneeth Subash	Comparitive Study of biohydregen Production in Microalgae and bacteria through fermentation process	Sree Chitra Thirunal College of Engineering Pappanamcode	10,000	30,000	2000	5000		47,000	CHEMICAL/BIOTECH
36	Biju Jacob Assistant Professor	Anslet Mary Abhinav Anil Anupama SS V Reshmi	Analysis and Optimisation of Process Parametres for Improving the Self Healing Capacity of Immobilized Bacteria Based Concreate	Sree Chitra Thirunal College of Engineering Pappanamcode	9960	29,000	2000	5000		45,960	CHEMICAL/BIOTECH
37	Venkitaraj K P Assistant Professor	Aneesh A Arun B Aswathy Elizabeth Jacob Aswathy Ramesh	Thermal Management of Photovoltaic Cell using PCM FOR Improved Efficiency and Power Output	College of Engineering Adoor	10,000	33,000	2000	5000		50,000	MECH
38	Deebu U S Assistant Professor	Aanand R Bhatt Ananthu Krishnan Arjun C O Shifas Shajahan	Smart door system with COVID-19 risk factor evaluation, contactless data acquisition and sanitization.	College of Engineering, Adoor	2000	12,000		2000		16,000	ECE

No	Faculty	Students	Project Title	College						Total	Dept
39	V. Praseeda Lekshmi Professor	Keerthi Nair Sangeetha.B Aditya Anoop Harikrishnan G	Traffic Surveillance System and Criminal detection using image Processing and deep Learning	College of Engineering Perumon	5000	15,000		1000		21,000	ECE
40	Archa A.B Assistant Professor	Anagha Jyotish Fathima.M Gayathry.S Sangeetha Santhosh	Foresight for visually impaired people.	College of Engineering Perumon	4000	8000		1000		13,000	ECE
41	Saritha M Assistant Professor	Vivek VS Sabari S Asan John Britto Karthik S	Water Cleaning Vaccum Pump and Quality	College of Engineering Perumon	5000	15,000	2000	2000		24,000	EEE
42	Rajesh.MS Assistant Professor	Sanjith.S Nimmy John Gowri Menon B Abhijith	Automatic Floor Cleaning Sanitizing Robot	College of Engineering Chengannur	5000	7500		1500		14,000	ECE
43	Dr. Sarah Jacob Associate Professor	Vishal B Nayana Girish Shamnad S	Pill Dispenser	College of Engineering Chengannur	5000	10,000		2500		17,500	ECE
44	Deepa J Professor	Abhishek P B Adithya Anil Anjali Balakrishnan Athena Anna Sabu	Wild Elephant Intrusion Detection System using Image Processing Techniques	College of Engineering Chengannur	2500	8000	1000	1000		12,500	ECE
45	Sherin Joseph Assistant Professor	Adithya Ahalya A Kumar Amrutha Mohan Shravan Sa	Smart cap for visually impaired	College of Engineering Chengannur	1000	11,000	1000		2000 (Rs. 1000/- for Research literature)	16,000	EEE
46	Rakesh R J Assistant Professor	Ajith Krishna S A Bona Das Vijaya Lekshmi M V Gokul Krishna V S	Smart Aqaponics System	College of Engineering Muttathara	600	8980		4500		14,080	CSE
47	Joby James Assistant Professor	Abhijith S Adarsh S Syam Saseendran	Detecting buried human bodies using ground penetrating radar in FPGA.	College of Engineering, Kidangoor	2500	4500		1000		8000	ECE
48	ASWATHY N ASSISTANT PROFESSOR	AISHA MEHRIN K I ASWANI M RAVI AUSHIN JOSE MANJOORAN FARHAN NAJEEB FINTO SHAJAN	MED-MATE	Adishankara Institute of Engineering and Technology ASI	5000	6000		1000		12,000	ECE

No	Investigator	Students	Project Title	College						Total	Dept
49	Abi Varghese Assistant Professor	Abhishek Prasad Albin Alex Uzhuvathu Ananthu Ramesh Ansan P Sam	Ergonomic modification and bio-mechanical analysis of the rubber tapping knife (michie golledege knife) for improving body posture of rubber tapper	Amal Jyothi College of Engineering, Kanjirappally	10,000	25,000	2500	5000		42,500	MECH
50	Abubeker K M Assistant Professor CoInvestigator K.G Satheesh Kumar Professor and HoD	Abey Joshy Arunima Tressa George G Gopika	Hardware and Open Source Software Deployment for Real-Time Monitoring of Hyperglycemia and Hypoglycemia Using Non-Invasive Biosensors and Machine Learning approaches.	Amal Jyothi College of Engineering Kanjirapally	5000	15,000		2000		22,000	ECE
51	Dr. S. N. Kumar Assistant Professor	Alen J James Andrew Dixen Naamah Susan Saji Riya Thomas	Portable Embedded System for Stress measurement- An aid for Human Health Care	Amal Jyothi College of Engineering Kanjirappally, Kottayam	1000	6000	1000	2000		10,000	EEE
52	Dr. Nimi Ann Vincent Assistant Professor CoInvestigator Anaswara S Assistant Professor	Neethu S Jomol Mariam Joseph Thomas P Joseph Roja S Emmanuel	A preliminary experimental study of mitigating coastal sand dune erosion by microbially induced carbonate precipitation (micp) using laboratory microcosm.	Amal Jyothi College of Engineering Kanjirapally	6000	15,000	4000	3000		28,000	CIVIL
53	Dr.Vishnu.M Assistant Professor	Digin Tense Jubin Biju Thomas Sreelakshmi NV Sruthy Jayasankar	Biodegradable Chitosan-Based Film for Food Packaging	Amal Jyothi College of Engineering Kanjirappally	5000	15,000	2000	5000		27,000	CHEMICAL/BIOTECH
54	Dr.Vishnu.M Assistant Professor	Thomas J Kallupurakel Jithin Jacob	Microbial Oil from Wastewater	Amal Jyothi College of Engineering Kanjirappally	7000	15,000	2000	2000		26,000	CHEMICAL/BIOTECH
55	Dr. Biju C V Professor	Jobin C J Edwin Anto Amal Paulson Mariya Shobby	Development and testing of resonance free mechanical structures for enhanced stability in dynamic conditions	Jyothi Engineering College Thrissur	10,000	20,000	5000	10,000		45,000	MECH
56	Arun J S Assistant Professor	Miladh Muhammed S Vishnu P Kumar Joshin Samuel	ROS based autonomous hospital assistant robot	Mar Baselios College of Engineering and Technology, Trivandrum,	3500	20,000		2500		26,000	ECE
57	Dr. M J Jayashree Professor	Aswin Nandu A C Harikrishna Sharma Gokul G S Tushar Kumar	Gesture controlled stair climbing wheelchair	Mar Baselios College of Engineering and Technology, Trivandrum,	4000	20,000		2000		26,000	ECE
58	Dr.Jayakumari.J Professor	Jobin J, Mr.Rohith M, Mr.Visakh Neelakantan	Development of IOT based energy autonomous parking sensor device	Mar Baselios College of Engineering andTechnology, Trivandrum,	3000	10,000		2000		15,000	ECE
59	Sherin Mathew Assistant Professor	Abhiram S Madhu Anakha S Karthik Santhosh Sifa Raisa S H	Blind spot detectors at A- Pillars for Road Safety	Mar Baselios College of Engineering and Technology	2000	4250	1000	1000		8,250	CIVIL

60	Dr. M Satyakumar Professor	Bijin S Russel Merlin P K Sandra A L Visakh S R	Two wheeler curve detection and pollution warming systems	Mar Baselios College of Engineering and Technology	2600	4000	1300	1300		9,200	CIVIL
61	Sreeja.S R Assistant Professor	Aparna LS ChelsiaEapen Muthulakshmi S Paliyath S Aju	Surround Perception and Audio Directing Device	Mar Baselios College ofEngineering and Technology, Trivandrum,	7000	18,750				25,750	CSE
62	Subha P S Associate Professor	Abhyshek R Srtutyhy Selvan Pereira Alka Gilbert D Sabarish	Braille printer	Marian Engineering College	5000		1000	2500		8500	ECE
63	Soorya SR Assistant Professor	Abdul Fayad Mohammed Yafi Shalima RS Ahmad Shiras Pooja Ajin	AUTOMATED WASTE SEGRAGATOR	Marian Engineering College Trivandrum	6500		2000	1500	10,000 (Additional expense for the specific work related to project)	20,000	CIVIL
64	Kannan K Assistant Professor	Aarcha MS Adarsh S Nair Ijas Ahamed Neha Felix	Effect of Geocell Reinforcement on Lateritic soils with Underground Void	Marian Engineering College Trivandrum	1200		4000	3000	37100(Additional Expenses for the specific work related to the projec)	46,300	CIVIL
65	Dr. Rittin Abraham Kurien Assistant Professor	Ashwin Santhosh Daniel Paul Gowrisankar B Kurup Greshma Susan Reji	Finite Element Analysis and Experimental Investigations on Natural Fiber Composites from Vetiver and Jute for Sustainable, Eco-friendly and Commercial Applications: Development, Mechanical and Morphological Property Estimation.	Saintgits College of Engineering	9950	25,000	4950	4970		44,870	MECH
66	Anu Raj Assistant Professor	Anju Sosa John Greeshma Thomas Sona Susan Zacharia	IoT based real time air & noise pollution alert system for asthma and angina patients.	Saintgits College of Engineering Kottayam	2000	7500		500		10,000	ECE
67	Harinarayanan Namboothiri M G Assistant Professor	Arjun K S Abhijith Arun Anpin Mary John Kevin Kallikunnil Varghese	Isolation Robot (ISO-BOT) for patient health care.	Saintgits College of Engineering Kottayam	5000	10,000		1000		16,000	ECE
68	Dr.N. Mahendran HOD	Abrar Ahmad Mallah Jerlin P Varghese Joenty Jose Mathew Philip	Hybrid Outdoor Lighting System using Gravitational Force	Saintgits College of Engineering Kottayam	1500	1750	1000	1000		5250	EEE

No.	Name / Designation	Students	Project Title	Institution						Total	Dept
69	Dr. Rajesh Baby Associate Professor	Bilbin Mathew Paul Vargheson Alan Philip Rajan	Development of an automatic height adjusting pillow to relieve chronic neck pain (cervicalgia).	St. Joseph's College of Engineering and Technology Palai.	10,000	25,000	5000	5000		45,000	MECH
70	Ivin Jose Assistant Professor	Thimothy Benny Akhil Krishnan Genesis J Cheruvallil Benchamin Tomy	Tool design and fabrication of hybrid electro discharge grinding setup for microchannels	St. Joseph's College of Engineering and Technology Palai.	10,000	25,000	5000	10,000		50,000	MECH
71	Dr. Madhukumar S Professor	Prince Jose Vijay Varghese Amal Varghese Jubin Thomas	Borewell rescue robot	St. Joseph's College of Engineering & Technology Palai	5000	15,000		1500		21,500	ECE
72	Anto Manuel Assistant Professor	Adithya Sunil, Ben Alphin Binny, Jobin Benny Roshan Rajeev	An Intelligent Device To Predict Cloud Burst	St. Joseph's College of Engineering and Technology Palai.	5000	15,000		1500		21,500	ECE
73	Dr. Praseetha V M Associate Professor	Anjana V M Tinu Sam Rona Mariam Shaji Tressa Mary Joseph	Gesture based device controlling system	St. Joseph's College of Engineering and Technology Palai.	3000	11,500		1800		16,300	CSE
74	Dr.Georgina Binoy Joseph Associate Professor	Akshara Sajeevan Ann Mary Abraham Aswathy Meria Peter Honeymol M Jose	SMART MIRROR	Toc H Institute of Science and Technology	2000	10,000		1500		13,500	ECE
75	Girish.P Assistant Professor	Anagha Biju Betty George KP Manjulika Sneha Baby.KX	ACCI-LERT SYSTEM	Toc H Institute of Science and Technology	2000	8000		1500		11,500	ECE
76	Dr.Rosebell Paul Asst. Professor	Neeraj M Neeraj Sagar Vaibhav Nair Yadukrishnan PS	An AI Based Swarm Wheel fot system to detect Cracks in Railway Tracks.	SCMS School of Engineering and Technology, Ernakulum, KarukuttY	8260	36,000		4,000		48,260	CSE
77	Harish T M Assistant Professor	Nandu Krishnan A U Nasmal Navas Sreekanth K.A	Development and fabrication of Al 7075 composite reinforced with industrial waste and clay	Federal Institute of Science ancl Technology, Ernakulam	10,000	10,000	5000	20,000		45,000	MECH
78	Manu Mohan C M Assistant Professor	Joheon C P Joseph Paul Linto Thomas Rajeev K R	Sign language to speech converter using machine design	Federal Institute of Science ancl Technology, Ernakulam	3500	10,000	500	2500		16,500	ECE
79	Sreevidya P Assistant Professor	Gokul Rejitkumar Godson Thomas	Integrated communication system for deaf and mute	Federal Institute of Science ancl Technology, Ernakulam	3000	10,000		1000		14,000	ECE
80	S Sundararajan Assistant Professor	Bilal Ibrahim P A Rajeena R Sony Shajan	Fruits adulteration detection system	Federal Institute of Science ancl Technology, Ernakulam	1500	5000		1000		7500	ECE
81	Panjami K Assistant Professor	Aleena Garvasis Apsara S Baiju Gayathri S Kumar Gokul S	Study on Effeetiveness of Mobile sensors in deteeting sutrsurface cavities- A step towards early detection of cavities at Kerala	Federal Institute of Science ancl Technology, Ernakulam	10,000		35,000	5000		50,000	CIVIL

82	Dr. Trijo Tharayil Associate Professor	Akhil A R Akhil Kumar K S Akhil Sankar Aswin Yesodharan	Thermal management of batteries in electric vehicles using pulsating heat pipe	Sree Buddha College of Engineering, Pattoor	10,000	25,000	5000	5000		45,000	MECH
83	SHAMNAMOL G K Asst. Professor	Ms. Sruthi J Nair Ms. Sredha J Nair	Bio-Synthesize of Zinc oxide Nanoparticles Using Banana Empty Fruit Bunch Extract for Corrosion Mitigation	Sree Buddha College of Engineering, Pattoor,	4630	7,433	3000	5000		20,063	CHEMICAL/BIOTECH
84	Dr. Shalini A Nair Associate Professor	Adithya.CV	Biosensing of stress Biomarkers	Mohandas College of Engineering and Technology	5000	10,000	1000	3000		19,000	CHEMICAL/BIOTECH
85	Vipin Vijayan Assistant Professor	GREGORY JAMES ABHINAV SYAM NANDU V NATARAJ PREJITH KUMAR P V	Value addition of banana pseudostem and fish scales in developing novel biocomposite for bone tissue engineered scaffold applications.	Muthoot Institute of Technology and Science, Ernakulam	9,950		4800	5000		19,750	MECH
86	Dr. Shoba Gopalakrishnan Associate Professor	Sreeram M Aleena Sara Varghese Sindhoora Harsha Daniel	Anti-drone Detection System.	Muthoot Institute of Technology & Science, Varikoli P.O., Ernakulam (MUT)	2000	5000		1000		8000	ECE
87	Dr. Chikku Abraham Vice Principal & Professor	Basil Saju Jones Mathew Cleetus Leo Benn Dominic Midhun Raj M	Investigation of a Novel Totem Pole Converter Using WBG Devices for On Board EV Chargers	Muthoot Institute of Technology and Science, Varikoli P.O	10,000	26,000	1000	4000		41,000	EEE
88	VenugopalanKurupath Associate Professor	Fadil Farooq Meenakshi S Riya Vinod Shabana M B	Development of Low Cost User Friendly Audiometric System	Muthoot Institute of Technology & Science Kochi-	5000	10,000	1000	3000		19,000	EEE
89	Dr Mary Lissy P N Associate Professor	Adithyan P S, Shefil C, S Afeeque, Thazneem A Saleem	Residential W energy system	Muthoot Institute of Technology & Science, Varikoli, Puthencruz-682308. College code: MUT	2750	9250	2000	2000		16,000	CIVIL
90	Nesihath MK Assistant Professor	Mohammed Fayis MV Kiran KM Adeeb Sameer Ahmed Ajsal UP	Smart Micro-grid Energy Management System Considering Vehicle to Grid Technology	MES College of Engineering Malappuram,MES	1000	18,000	1000	1000		21,000	EEE

Dean Research

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Terms & Conditions for Financial Assistance to Student Projects

1. The amount has to be utilized as per budget provision under each head.

2. The purchase of equipments shall be in accordance with the store purchase rules. All equipment purchased will be the property of the University and the stock entry of the items purchased shall be maintained in the College. Purchase of computers/peripherals is not allowed unless specifically mentioned in the sanction order.

3. The stock entries of consumables purchased shall also be done in the consumables stock register of College. Purchase of stationery shall be for project purpose only. Printing charges for multiple copies of the project report will not be admissible.

4. The maximum duration of the project is one year from the date of sanction. It is the discretion of the University to settle amount towards the purchase of those items not clearly mentioned, if any, in the project proposal.

5. On completion of the project, detailed report of the research work, audited statement of accounts Utilization Certificate and Expenditure Statement in the prescribed format duly attested by the head of the institution along with original bills towards expenditure incurred with payment certificate of the Principal Investigator shall be submitted within one month of completion of the project for reimbursement of expenditure. The Bank Account details of the Principal shall be submitted along with the request for reimbursement. Requests for reimbursement shall not be considered after the date of submission of documents as above.

6. For reimbursement of expenses under the head **Travel**, Train tickets/Bus tickets/Taxi receipts, in original, affixing payment certificate of the Principal Investigator specifying the purpose of travel with actual distance of journey and fare shall be submitted.

7. On all publications resulting from the finding of the research/project, due acknowledgement shall be given to the University.

8. Book or literature purchased, if any, should be taken into the Stock Register of Central Library or Department library and then distributed to the investigators.

9. The expenditure under the head **Others** is admissible as per the budget proposed. All other expenditure has to be included in the head Contingencies.

Title of Project

Signature of Principal Investigator:

Name:

Office address:

A SWARM BASED AI AIDED WHEEL BOT SYSTEM TO DETECT CRACKS IN RAILWAY TRACKS

INTRODUCTION

Indian Railway is one of the largest transportation networks in the world. It has a daily passenger count of 24 million passengers.For such a vast network the possibilities of lapses in safety is alarmingly high.

One of the major causes of hazard would be disruption in locomotive movement. Cracks in railway tracks have been identified as one of the major causes of railway accidents.Currently there isn't a fail proof system to detect and fix cracks on railway tracks. The system still follows the primitive methods of manual checking and solving.The project focuses on providing a real-time solution to the identified cracks on railway tracks. Once identifying a crack as a threat the agent aims at alerting the nearby agents as well as a base station by an active communication channel that updates the status in real-time. The projects implements a wheel-bot (UGV) which is able to differentiate between cracks and intentional gaps(thermal expansion). The Robots Dynamically communicate with other agents (Swarm Robotics approach) and the main workstation to relay information regarding the problems

identified.Once the agent has identified a crack, it is intimated to the nearest base station for the track engineer to address the issue at the earliest.It also communicates to its nearest agents and alerts them regarding the identified setback. The system also tries to provide a safe environment for the locomotive system in the regions of animal crossing.

BACKGROUND AND MOTIVATION

Railway is the most essential form of transport in India, as it provides long-distance, comfortable travel within a budget for a commoner. According to the NCRB Annual Report 2020, there were 27,987 train accidents in 2019, 13,018 in 2020. The report also revealed that as many as 11,986 railway passengers were killed and 11,127 were injured in these accidents during the past year of 2021. Accidents like these can happen to various reasons, one of the most prominent being the cracks in railway tracks. The very concept of the project lies within identifying the type of cracks on the tracks. They are of two types, one being the intentional gaps left on the tracks for thermal expansion during summer. The other being the faulty cracks which can cause a catastrophe as dangerous as derailment of the train of the tracks. The current system lacks any kind of novel technology to identify and rectify faulty cracks. This project tries to work on this problem and provide a real time solution. The project also takes the vast scale of the domain into consideration. So it tries to provide a solution that requires minimal human interference and mobile management.

METHODOLOGY

The system is divided into clusters. Each cluster has a base station and a fixed number of agents. These agents follow swarm robotic architecture. The agents are deployed on the tracks. The number of agents in a cluster is determined by the maximum communication range of an NRF module which is the communication unit used in the product. The aforementioned can be extended up to 3 km. The cluster also has a fixed number of free robots that replace the working agents in case of a fault or low battery. The designed UGV is a four-wheeled bot that is deployed directly onto the railway tracks.
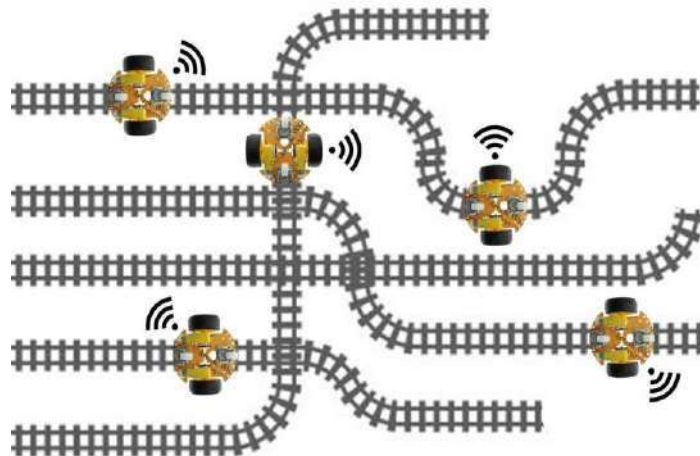
SYSTEM ARCHITECTURE

The system mainly comprises the communication unit and the sensor data processing unit. Communication is responsible for the efficient exchange of data between the agents as well as the base station. The agents communicate to the nearest bots and base station in the case of any kind of hindrance identified by the sensor data processing unit. The sensor data processing unit is responsible for the detection of different types of cracks, obstacles, and faults in the agent itself. Various sensors are integrated and implemented for fault detection. The data is fed to the Arduino board which handles the communication and sensor data processing tasks.

The raspberry module is integrated in the system for image processing. The project aims toward efficient animal crossing detection which is common on the Indian railway tracks due to the terrains it passes through. The agents will be equipped with an FPV camera, which captures images when it encounters live object detection. Then running efficient image processing algorithms it identifies the subject in front of it and starts over only when the path is clear.

The model is also equipped with a GPS module which helps 7the other agents know its current location when it sends out data in case of fault detection. This helps other agents to reach that specific location and aid it. It also helps the base station to know the location of the fault.
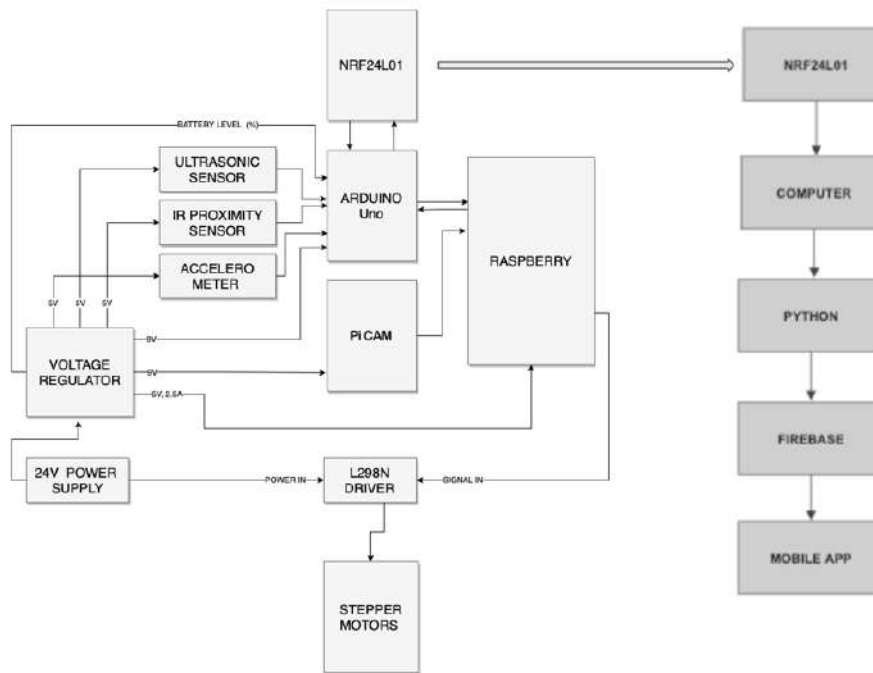
COMMUNICATION UNIT

The communication unit is set up primarily using an NRF24L01 module. The inter-system communication happens in the case of:

● Crack detection

● Obstacle detection

● Animal crossing detection

● Agent failure

On the onset of any of the aforementioned conditions,the agent sends its location, proximity, X-Y coordinate values of accelerometer, IR proximity, temperature values to the assigned base station and nearby agents within communication range. A single RF channel with multiple communication pipelines is established with a dedicated pipeline for each of the agents. The agents constantly send data to their respective cluster base station which can be

viewed on the android application. It shows a warning signal along with a trigger alarm when an agent detects an anomaly. It also communicates to the nearby agents when an anomaly occurs. A single agent can communicate up-to 6 agents at a time and has a maximum communication range of 3 km.

SENSOR AND PROCESSING UNIT

The sensor unit mainly comprises:

● Ultrasonic sensor (Obstacle detection)

● IR Proximity sensor (Crack detection)

● MPU6050 (Fault detection)

The ultrasonic sensor mounted in front of the agent continuously sends trigger pulses in front of it till certain proximity. In case of occurrence of an obstacle, it receives an echo back, meaning the pulse has hit a physical object and the agent confirms detection of an obstacle on the track.
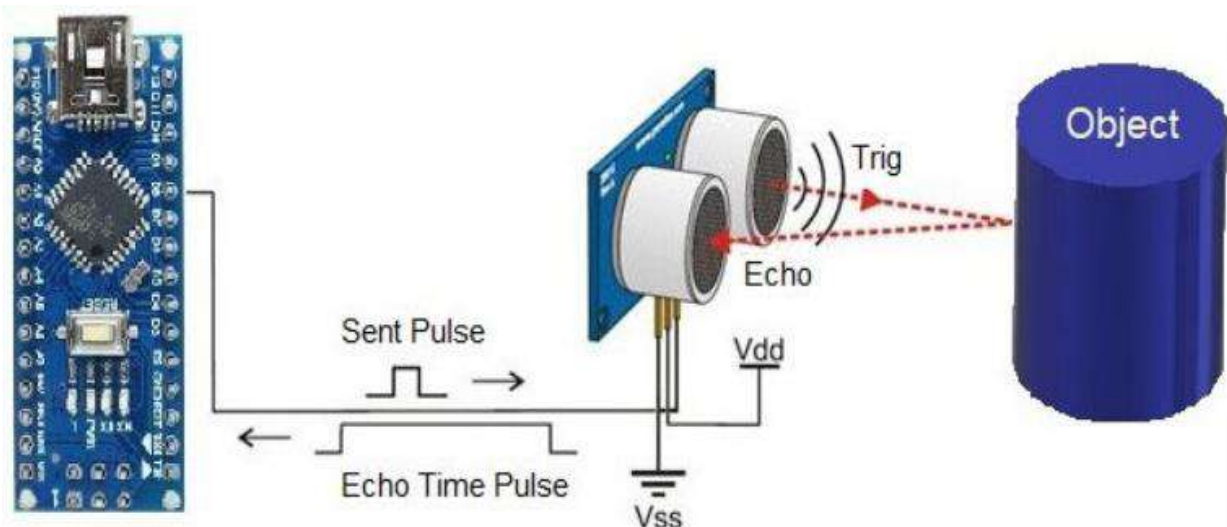
ANDROID APPLICATION

An Android application is developed to alert the officials and the concerned individuals regarding the emergency condition that has to be addressed fast. The developed app gives the provision to know the different values of the sensors which include an IR sensor, a combined sensor module of Temperature and Accelerometer called MPU 6050, and a GPS module. The app gives an alert alarm and a warning image as the sudden response to cracks or any other obstacle encountered by the bot during their routine crack detection checkup. It consists of a parallel display providing a side-by-side view of the status of each bot. The app also consists of the two buttons named BOT_1 and BOT_2 which once clicked will lead to the live location of the robot where they are present. The approximate distance between the two robots will be displayed between the two buttons. This app is basically an interface that helps the authorities to know when to start the accident prevention steps. Basically, this app provides full-fledged access to know all the details regarding the robot including their nearest distance. The alarm system in the application causes a sudden alert throughout and constantly rings until an immediate step is taken. This app will be provided only to the Railway Authority officers as there are high chances of this app getting misused. The distance between the coordinates namely Latitude and the Longitudes are calculated using the Haversine formula. When one robot is getting tampered with or derailed, then the nearest robot will come to assist the damaged robot. The nearest distance is hence calculated with the help of the haversine formula.

ANIMAL DETECTION UNIT

The pathways of the crack detection robots are medalled with a plethora of obstacles and dangers. The bot actively responds against non-living obstacles using its array of proximity sensors. The next challenge are the living obstacles and dangers caused in specific locations like animal crossings and wildlife sensitive areas. Elephant crossings along various railway tracks can cause untimely disruptions in the proper movement of the robot. An efficient way to tackle this problem is a real-time animal detection system that takes in live camera feed and detects elephant crossings present in the frame. On the detection of an elephant the robot is signaled to halt its movement and wait for a safer environment to continue its movement by analyzing the live camera feed. The process of animal detection is carried out on a Raspberry Pi module attached onto the robot. Upon detection the Raspberry Pi is programmed to provide a motor signal to the required L298N motor driver module. Detecting an object entails both stating that an object belonging to a specified class is present, and localizing it in the image. The location of an object is typically represented by a bounding box.

RESULTS AND DISCUSSION

The prototype was successfully run on the simulated railway tracks and the results suggest that the final model can be successfully run on the actual railway track along with the implementation of auto-detachment feature from the track feature. The trains will be set up with proximity sensors and using the geo-location of the trains, when the train is within a proximity threshold distance, the agent proceeds to detach itself off the tracks onto the surface of the tracks. The agent uses actuators to lift itself off the track, then scissor hinges flips the wheels inside the tracks and the actuator proceeds to rest the agent onto the base of the tracks. The agent then lifts back up and places itself back onto the track when the train leaves the proximity threshold region.

The integration of the Indian railway database with the model can make the project extendable across the railway network of the country. With access to geo-location of trains and the thermal expansion tracks along with the train timings and delays, the efficiency of the model can be increased exponentially.

The success of the whole project revolves around the auto-detachment feature. A number of alternatives were brainstormed and discussed out, from the spider-bot model to linear actuators stand alone. After extensive research, cross-hinges along with linear actuators

along the wheels was confirmed to be the most feasible and suitable model for our project. This made sure there was an equal distribution of weight throughout the base of the robot. It also ensured a sturdy, fool-proof and hasty mechanism.

The inclusion of animal detection, arose from the obstacle detection module, when the presence of animal crossing was taken into consideration. When the obstacle detection module was being implemented, it was realized, the agent has to be cautious about not just the static, but the dynamic(animals) obstacles which may hinder the movement of robot on the track. Thus, the concept of image processing was brought up, which will help the agent identify if any kind of animal crossing is going on, on the tracks in front of it. Based on the type of animal crossing and the behaviour the animal exhibits, the robot can accordingly decide the amount of time it has to halt, before restarting its movement.

HIGHLIGHTS

This project consist of many features which enhances the credibility and use of the system. An application that supports the real-time data transfer and an alarm system is added to the app. As a next step to future implementations we have included an advanced feature of image processing. The app which is mentioned above consist of certain features which include an alarm and specific values of the corresponding cracks and defects which are found on the rail. Each feature contains a specific threshold beyond which the alarm starts to beep and a warning message will be popping up. Image Processing section will be dealing with the objects encountered by the bot. The proposed system is a swarm system and supports multiple bots and any damaged or derailed robot will be supported by the neighboring robot.

UTILIZATION CERTIFICATE

Certified that out of Rs ....48260/-.............. sanctioned by Centre for Engineering Research and

Development of APJ Abdul Kalam Technological University towards financial assistance for the

student project titled ' .A SWARM BASED AI AIDED WHEEL BOT SYSTEM TO DETECT CRACKS ON RAILWAY TRACKS ', an amount

of Rs ......41110.3/-..... was utilized for the purpose for which it was sanctioned, leaving a balance

of Rs. .7149.7/-... at the close of 8-09-2022............ as shown in the Statement of Expenditure

annexed.

For SUBHASH CHANDRAN ASSOCIATES
CHARTERED ACCOUNTANTS

S ABHILASH CHANDRAN B.Com, FCA
PARTNER. (M. No. 223576)
FRN 0040055

Name & Signature
of Principal Investigator

Name & Signature
of Head of the Institution

Name & Signature
of Accounts officer/
Chartered Accountant

Dr. ANITHA G. PILLAI
PRINCIPAL
SCMS SCHOOL OF ENGINEERING
AND TECHNOLOGY

UDIN Z3223576 BGYJBM5227

Office Seal

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CET campus, Thiruvananthapuram - 695 016
Ph: 0471 2598122; Fax: 2598522 www.ktu.edu.in Email: university@ktu.edu.in

No. KTU/RESEARCH 2/4643/2020   Dated: 02.09.2021

From

  The DEAN (Research)

To

  The Principal
  SCMS School of Engineering and Technology

Sir,

  Sub:- APJAKTU - CERD - Research Seed Money Scheme - Projects Selected for
  funding - reg:-

I am glad to inform you that the project proposals as listed in Annexure I are provisionally
selected for funding under Research Seed Money (RSM) scheme of KTU.

The expenditure should be incurred as per the sanctioned budget heads and in accordance
with terms and conditions given in Annexure II. Format of MOU to be furnished by the
college is given as Annexure III.

The Principal Investigators may please be directed to forward request (in Annexure II) for
releasing the fund with Bank Account details. The fund will be released only after settling
pending accounts of the principal investigator in CERD, if any. Any request received after
three months from the date of this letter will not be considered.

                                                       Yours faithfully
                                                       Dr. Shalij P.R *
                                                       DEAN (Research)

Copy To

  1. Vinoj P. G, Assistant Professor in ECE.
  2. Y. K. Remya, Assistant Professor in Civil Engineering.
  3. Susmi Jacob, Assistant Professor in Computer Science.

* This is a computer system (Digital File) generated letter. Hence there is no need for a physical
signature.

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Centre for Engineering Research and Development
Request for releasing RSM grant

Title of Project:

Date of sanction:

Amount sanctioned:

Account No and bank details:

Terms & Conditions for Research Seed Money Scheme

1. The amount sanctioned for the project shall be deposited in a separate joint A/c of Princ Investigator and Head of the institution where the Principal Investigator works. (Name of A/c: CE Research Seed Money - File No.)

2. The maximum duration of the project will be three years from the date of st of the project

3. The amount has to be utilized as per budget provision under each head. It is the discretion of University to settle amount towards the purchase of those items not clearly mentioned, if any, in project proposal.

4. The purchase of equipments shall be in accordance with the store purchas rules. All equipment purchased will be the property of CERD and the stock entry the items purchased shall be maintained in the College signed by the Investigato Lab in charge and Principal. Purchase of computers/peripherals is not allowe unless specifically mentioned in the sanction order.

5. For Private self financing Colleges, 50% of the actual Equipment cost subjected to the maximum of sanctioned amount will be reimbursed by KTU if and only if the proof of remittance of other 50% is produced by the college.

6. The stock entries of consumables purchased shall also be done in the consumables stock register of College. Purchase of stationery shall be for project purpose only.

7. Books and literature purchased should be taken into the Stock Register of Central Library or Department library and then distributed to the investigators.

1

8. The interest accrued will also be accounted in the project.

9. On completion of the project, detailed report of the research work (hard and soft copies), audited statement of accounts and Utilization Certificate in the prescribed format duly attested by the head of the institution shall be submitted within one month on completion of the project for settlement of accounts.

10. If the project is not completed within the time limit, the grant amount should be   reimbursed along with the interest accrued.

11. The CERD reserves the right to terminate the project at any stage if it is convinced that the grant has not been properly utilized or appropriate progress is not being made. In addition, the CERD may designate Scientist/Specialist or an Expert Panel to periodically review the work done. The Principal Investigator has to appear for the periodic review meetings.

12. If the PI to whom the project has been sanctioned, leaves the Institution, the Head of Institution/PI shall inform the same to the CERD and in consultation with the CERD, evolve steps to ensure successful completion of the project, before relieving the PI.

13. Investigators must acknowledge the CERD in reports and technical/scientific papers published based on the research work done under the project. Investigators are requested to publish some of the research papers emerging out of the project work in leading Journals.

14. If the results of research are to be legally protected by way of patent/copy rights etc. the results should not be published without action being taken to secure legal protection for the research results.

15. The knowledge generated from the project will be the property of the CERD and should be properly acknowledged. Transfer of technology generated shall be done in consultation with the CERD.

We agree to the terms and conditions stated above. Please transfer the amount to the above bank account.

Signature of Principal Investigator:

Name:

Designation:

Signature of Head of Institution:

2

Name:

Office Address:

Seal

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
CENTRE FOR ENGINEERING RESEARCH AND DEVELOPMENT
College of Engineering Trivandrum Campus
Thiruvananthapuram.
Pin 695 016

RESEARCH SEED MONEY

Name & address of the Principal Investigator:
VINOJ P.G, ASSISTANT PROFESSOR,
ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT, SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY, VIDYANAGAR, PALISSERY, KARUKUTTY, ERNAKULAM-683576
MOBILE NUMBER: 9446276238   EMAIL:vinojpg@scmsgroup.org

Title of the Research Proposal: Brain Actuated Assistive Technology for the paralyzed

Broad Subject area/field of classification: Brain Computer Interface (BCI), Medical Electronics/Assistive Technology

Terms and Conditions

1. The scheme is constituted for the purpose of providing assistance in the form of grants to initiate research work in Engineering and Technology with particular relevance to the State of Kerala in the economic and industrial development.

2. Grant will be released to the Principal Investigator of the project through the Head of the institution.

3. The maximum duration of the project will be three years from the release of grant.

4. On completion of the project, one copy of the final project report on the work done should be sent to the CERD KTU along with the utilization certificate (UC), certified bills, bill wise statement and statement of expenditure (SE). Copy of the relevant pages of the Bank pass book should also be attached along with the documents for settlement.

5. The institute shall maintain separate audited accounts for the project.
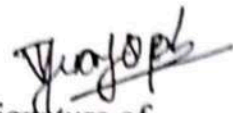
6. The institute shall not entrust the implementation of the work for which the grant is being sanctioned to another institution nor shall divert the grant receipts to other institute as assistance.

7. The CERD KTU reserves the right to terminate the project at any stage if it is convinced that the grant has not been properly utilized or appropriate progress is not being made. In addition, the CERD KTU may designate a Scientist/Specialist or an Expert Panel to review the work done.

8. If the PI to whom the project has been sanctioned leaves the Institution, the Head of Institution/PI shall inform the same to the CERD KTU and in consultation with the CERD KTU, evolve steps to ensure successful completion of the project, before relieving the PI.

9. Investigators must acknowledge the CERD KTU in reports and technical/scientific papers published based on the research work done under the project. Investigators are requested to publish some of the research papers emerging out of the project work in leading Journals.

10. If the results of research are to be legally protected by way of patent/copy rights etc. the results should not be published without action being taken to secure legal protection for the research results.

11. The knowledge generated from the project will be the property of the CERD KTU and should be properly acknowledged. Transfer of technology generated shall be done in consultation with the CERD KTU.

12. For Private self-financing Colleges, 50% of the actual Equipment cost subjected to the maximum of sanctioned amount will be reimbursed by KTU if and only if the proof of remittance of other 50% is produced by the college.

13. Equipment details must be entered in a separate stock register for the RSM project signed by the investigator, lab in charge and Principal. A separate stock entry certificate has to be furnished by the Principal Investigator with the authentication of Head of Institution.

14. The grant amount should be deposited in a separate bank account in the name of the Principal investigator and Head of Institution jointly.

15. The interest accrued shall also be accounted in the project.

16. If the project is not completed within the time limit, the grant amount should be reimbursed along with interest accrued.

Fund Received
only by 2022

17. The CERD KTU may enforce additional guidelines for the operation of research project from time to time and the Institution/Investigators are required to observe such directions in the conduct of the research work.

We agree to the terms and conditions stated above.

VINOJ P·G

Name & Signature of
Principal Investigator

Name & Signature of
Prof-in-charge
CERD Satellite Centre

(Office Seal)
SCMS SCHOOL OF ENGINEERING TECHNOLOGY
KARUKUTTY
ERNAKULAM
683 582

Name & Signature of
Head of Institution
DR. PRAVEENSAL
PRINCIPAL
SCMS SCHOOL OF ENGINEERING AND TE

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CENTRE FOR ENGINEERING RESEARCH AND DEVELOPMENT
College of Engineering Trivandrum Campus
Thiruvananthapuram. Pin 695 016

Application format for Research Seed Money

1. Title of the Research Proposal: Brain Actuated Assistive Technology for the paralyzed

2. Name & address & experience of Investigator: VINOJ P.G,ASSISTANT PROFESSOR,ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT,SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY,VIDYANAGAR,PALISSERY,KARUKUTTY,ERNAKULAM-683576 MOBILE NUMBER:9446276238   EMAIL:vinojpg@scmsgroup.org
   Experience: Teaching :10 years 4 months   Industry: 2 years

3. Teaching experience: 10 years 4 months
   Assistant Professor at SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY from 2-09-2010

4. Objectives (150 words):

   - To develop a Brain-controlled assistive technology for the paralyzed
   - To develop a low-cost, flexible and Light weight alternative for exoskeleton
   - To control exoskeleton movements using human Intentions
   - To automate the post-stroke rehabilitation and assistance using artificial Muscle Intelligence
   - To develop communication aid for the paralyzed to express their feelings

5. Broad Subject area / field of classification
   Brain Computer Interface (BCI), Medical Electronics/Assistive Technology

6. Project Type(s)
   (Basic Research / Applied Research / Developmental / Demonstration / Others
                  Demonstration

7. **Abstract (400 words)**
Due to partial or full paralysis due to stroke, the majority of patients are compelled to rely upon parental figures and caregivers in residual life. With post-stroke rehabilitation, different types of assistive technologies have been proposed to offer developments to the influenced body parts of the incapacitated. In a large portion of these devices, the clients neither have control over the tasks nor can get feedback concerning the status of the exoskeleton. Brain Computer Interface (BCI) controlled assistive technology is the new paradigm, providing assistance and rehabilitation for the paralyzed. But, most of these devices are error prone and also hard to get continuous control because of the dynamic nature of the brain signals. Moreover, existing devices like exoskeletons bring additional burden on the patient and the caregivers and also results in mental fatigue and frustration. The proposed framework tackles these issues utilizing a Brain Actuated Assistive Technology for the Paralyzed (BAATP), in which the exoskeleton movements are controlled based on user intentions. The BAATP uses a flexible design which can be customized according to the

degree of disability. The BAATP system also automatically identifies the status of the person and transmits information securely using Novel-T Symmetric Encryption Algorithm to caregivers in case of emergencies. The exoskeleton is fitted with actuators and motors controlled by the human intentions of the user with an Electroencephalogram (EEG) head BCI interfaced micro-controller controls the high torque motors and actuators connected exoskeleton joints based on user intentions. To automate the rehabilitation process, A Muscle Intelligence (AMI) is incorporated in the proposed system. AMI integrates user intentions with artificial muscle movements in an efficient way to improve the performance. Human the captured using Electroencephalogram EEG sensors are transformed into body movement utilizing micro-controller and Transcutaneous Electrical Nerve Stimulation (TENS) device signals are subjected to pre-processing, feature extraction and classification, before being on to the affected body part. The system also provides a feature for communicating intentions as an alert message to caregivers, in case of emergency situations. This is achiev offline training of specific gesture and online gesture recognition algorithm. The recog gesture is transformed into speech, thus enabling the paralyzed to express their feelings to rel or friends. Experiments were carried out with the aid of healthy and paralyzed subjects. The system can reduce mental fatigue, miss-operation, frustration, and provided continuous co The thrust of lifting the exoskeleton is also reduced by using lightweight wireless electrodes proposed system will be a great communication aid for the paralyzed to express their thoughts feelings with dear and near ones, thereby enhancing the quality of life.

8. Scientific scope of the Research proposal (400 words)

The recent survey by reeve foundation revealed the impact of paralysis on world popula affecting approximately 5.4 million people. The survey also identified stroke (33.7%) as the m cause for paralysis. Exoskeleton-assisted technologies have emerged as a reliable means rehabilitation of the affected upper and lower limbs. Because of the dynamic and uncertain natur brain signals, most of the BCI systems result in miss-operation, mental fatigue and it is hard produce continuous control. The proposed system is designed to address the above gaps research. The Brain Actuated Assistive Technology for the Paralyzed (BAATP) analyses the hum thoughts and transforms it into different movements on a unique exoskeleton structure. T contributions of the research are,

1. A Brain Actuated Assistive Technology for the Paralyzed (BAATP), in which t exoskeleton movements are controlled based on user intentions.
2. An adaptive mechanism based on sensory feedback integrated with the exoskeleton reduce the system false rate.
3. A flexible design for the exoskeleton which can be customized according to the degree disability.
4. Automatic identification of the status of the paralyzed person and secure transmission information to caregivers in case of emergencies
5. An Artificial Muscle Intelligence (AMI) system, in which adaptive mechanism based recorded muscle movements is integrated with the system to enhance continuous contr and facilitate rehabilitation.
6. Communication aid is incorporated in the system using gesture recognition
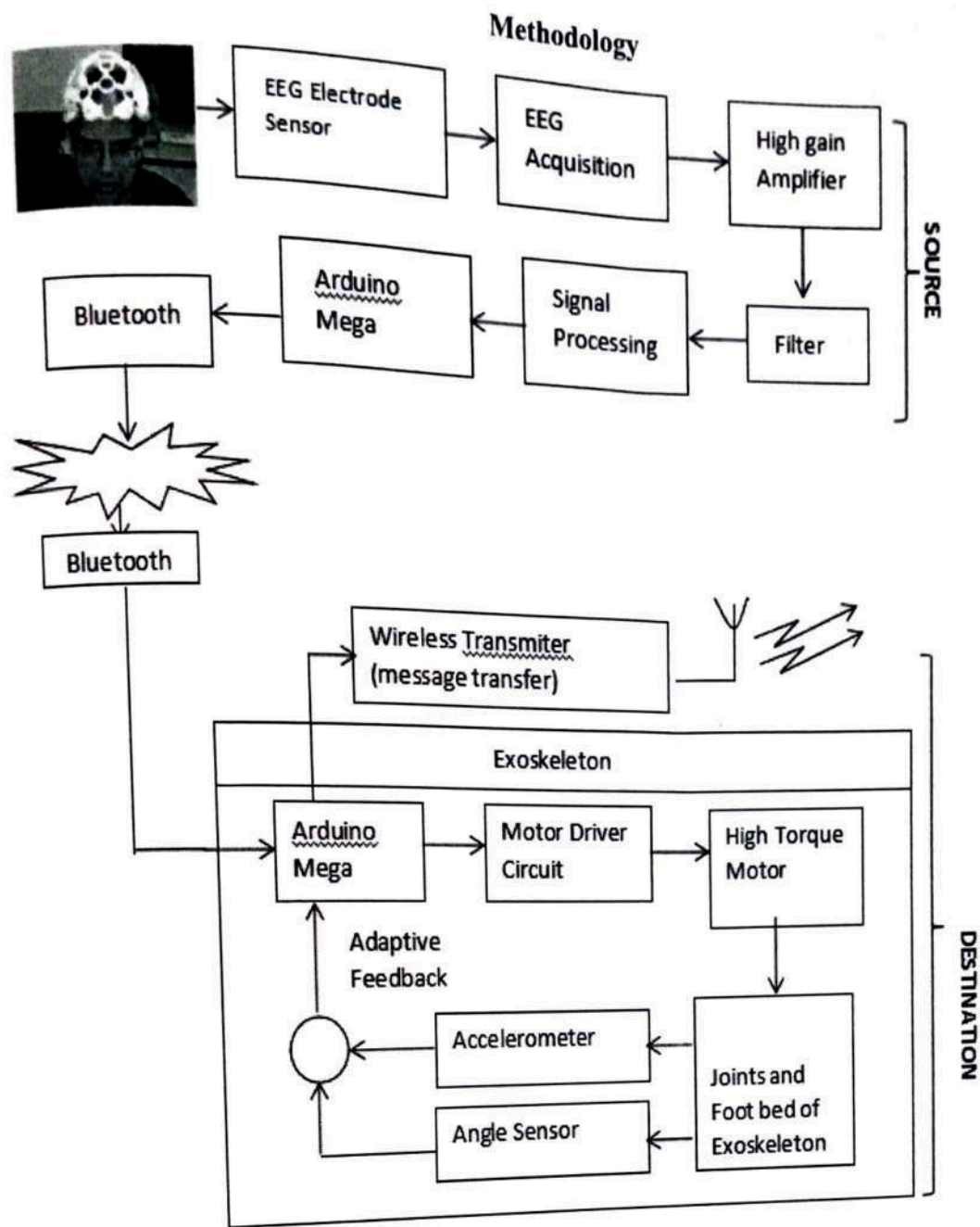
Methodology

FIGURE 1.   System architecture for Brain Actuated Multidimensional Exoskeleton

The architecture of the proposed system is presented in figure 1. The system design comprises an exoskeleton that replicates a lower limb, which is made using carbon fiber. The exoskeleton has total six degrees of freedom including both legs, one on each side of the pelvic bone, one on each knee and one on each ankle. Thus three degrees of freedom on each leg making it total of six degrees of freedom on the entire exoskeleton. Each joint of the lower limb is actuated using high torque motors. The movement of the exoskeleton is facilitated by controlling the degree of rotation of the motors. This exoskeleton is strapped onto the abdomen as well as foot region for improving the stability and balance of the person. Support is also provided on the back side of the ankle region. The angle sensors are placed on the joints to provide feedback regarding the status of exoskeleton. This sensor is also used to validate whether the applied force is sufficient to stabilize the

exoskeleton. The fall detection mechanism is implemented by placing an accelerometer on the back side of the lower limb to measure the tilt. If the measured sensor value crosses the threshold, a message will be given to the caregivers for emergency rescue.

The exoskeleton is controlled through human intentions. Electroencephalograph (EEG) sensors use non-invasive methods to collect the brain signals from the scalp of the person. EEG sensor has 14 electrodes incorporated in structure, where two electrodes act as the reference for measurement. The conductivity of the electrodes is improved by using gold plating. The signals collected are amplified using a high gain amplifier and a band pass filter is used for filtering high-frequency noise. In the signal processing stage, the signal undergoes further pre-processing and filtering. The suitable pattern based on the mental command is selected by using windowing technique. The signal is converted into digital data which is given as input to the micro-controller. The micro-controller does the classification of each mental command based on the feature extraction. In the training phase users will be trained for five basic commands (sitting, standing, forward movement, right turn, left turn). The recorded patterns during the training phase will be used by the micro-controller for decision making. The recognized thought patterns will be mapped to five different commands. During the testing phase, the controller makes use of machine learning to recognize and match patterns in the input data along with the training data that is already stored in the system to make the necessary decision regarding the action to be performed. The activation command to the exoskeleton is given by the controller through the Bluetooth module. At the receiver side the micro-controller converts this command into motor action which in turn moves the desired parts of the exoskeleton. Using a three-level sensing mechanism, feedback is given to the micro-controller regarding the status of the exoskeleton. Based on this feedback the micro-controller makes the desired corrections on the activation signals. The sensory feedback gives more stability to the system, and moreover rescue messaging systems are also implemented in case of emergencies.

9. Applications / Socioeconomic importance
(The relevance, if any, to the utilization and management of the natural resources of the State)

As per the "Disability Census 2015" 2.2% of the Kerala state population is suffering from various disabilities. This project can have impact directly on approximately 8 lakhs people in Kerala and 2 million people in India. The major applications of the proposed project and its importance are listed below

1) The proposed Brain Actuated Assistive Technology for the Paralyzed (BAATP) will bypass the brain clotting and help the paralyzed person to move their paralyzed parts using Muscle stimulation

2) Our product is unique because we are incorporating rehabilitation and communication assistance in the same system itself. The Multi-dimensional system helps in Rehabilitation and intuitive communication for the paralyzed. Most of the existing assistive devices provides only rehabilitation/motion

3) Non-invasive alternative to currently existing exoskeleton designs, which is lightweight and easy to Lift

4) An adaptive mechanism based on sensory feedback integrated with the exoskeleton to reduce accidental fall rates

5) The BAATP uses a flexible Exoskeleton design which can be customized according to the degree of disability

6) Caregiver Interventions are minimized with the use of deep learning algorithms. Most of the existing systems require dedicated caregivers

7) The proposed system provides better classification accuracy and reduced false rates.
8) Deep learning algorithm helps to reduce mental fatigue and provides continuous Control
9) The major advantage of this innovation is that it can be applied to any existing assistive technology like MMIP (muscle to muscle interface for the paralyzed), Exo-skeleton etc. with minor modifications
10) This system can be easily passed down to any living beings which is having communication disabilities
11) The proposed system will be a great communication aid for paralyzed to express their thoughts and feelings with dear and near ones, thereby enhancing the quality of life

10. Scientific background of the project

a) Importance of the problem

1. The solution to the proposed problem can have direct/indirect impact on 21 Million peoples in India and 100 million people world-wide as per the Reeve foundation survey
2. Problem is aimed at enhancing the quality of life of the paralyzed
3. The Multi-dimensional system helps in Rehabilitation and intuitive communication for the paralyzed. Most of the existing assistive devices provides only rehabilitation/motion
4. Project can have impact on the existing exoskeleton designs, making it lightweight and easy to carry
5. Caregiver Interventions are minimized with the use of deep learning algorithms. Most of the existing systems require dedicated caregivers
6. Enhance user experience by reducing mental fatigue and provides continuous control
7. The proposed solution to the problem will be a great communication aid for paralyzed to express their thoughts and feelings with dear and near ones

b) Related work already performed or in progress at your organization or in the state.

1) Muscle Machine Interface for the paralyzed (MMIP) at SCMS School of engineering and technology, Karukutty
2) Brain Controlled Robot at SCMS School of Engineering and Technology, Karukutty

c) Related work already performed or in progress at other places in India or abroad.

1) BCI based Control, CDAC, Noida
2) Brain Control devices,CBR,IISc Bangalore
3) Re-walk Robotics,USA is an innovative medical device company that designs, develops, and commercializes robotic exoskeletons,
4) Home automation and smart wheel chair based on Electroencephalography (EEG) signals produced in brain",BITS,Pilani

11. Details of any preliminary work done by the investigator

- Literature survey and market study of existing Assistive devices, Identified the gaps in existing designs
- Tie-up with Sunrise hospital,Kochi to interact with paralyzed persons and medical practitioners
- Tie-up with NeuroSky and Backyard Brain, USA for expertise in EEG sensor design
- Real-time EEG data Acquisition and Analysis using Emotive EPOC mobile EEG headset
- Customized EEG sensor designed with 16 Electrodes
- Exoskeleton designed for the actuation of the affected lower Limb
- Implemented and Tested Brain-Controlled lower limb exoskeleton on the paralyzed patients and healthy subjects
- Developed an alternative method for Muscle stimulation without using exoskeleton
- Brain signal Analysis using realistic head models

Figures of Implementation/Simulations
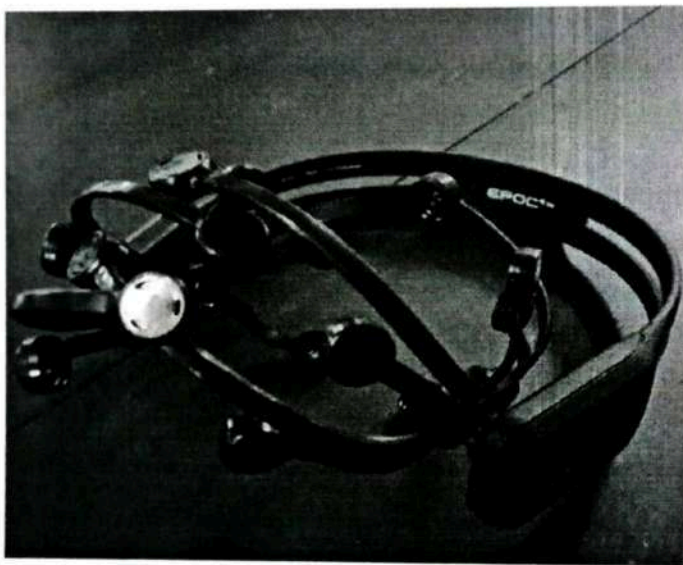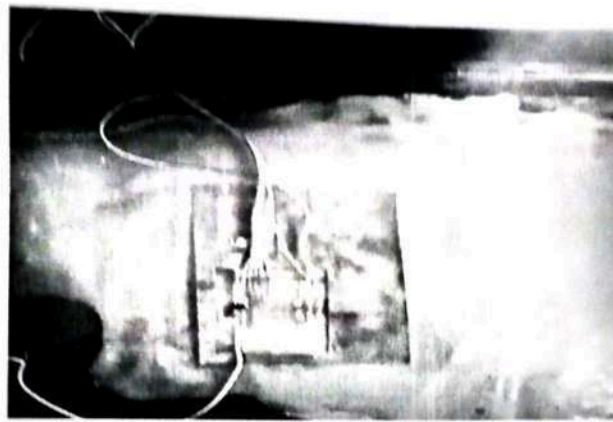

Figure 1. Emotive EPOC mobile EEG headset
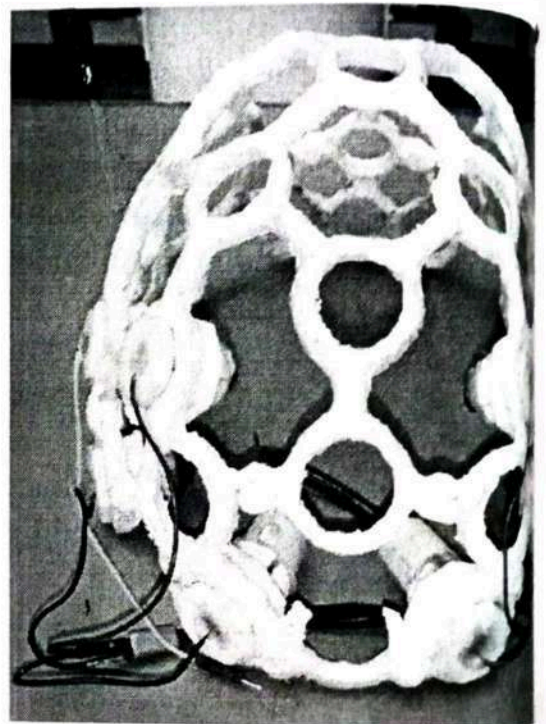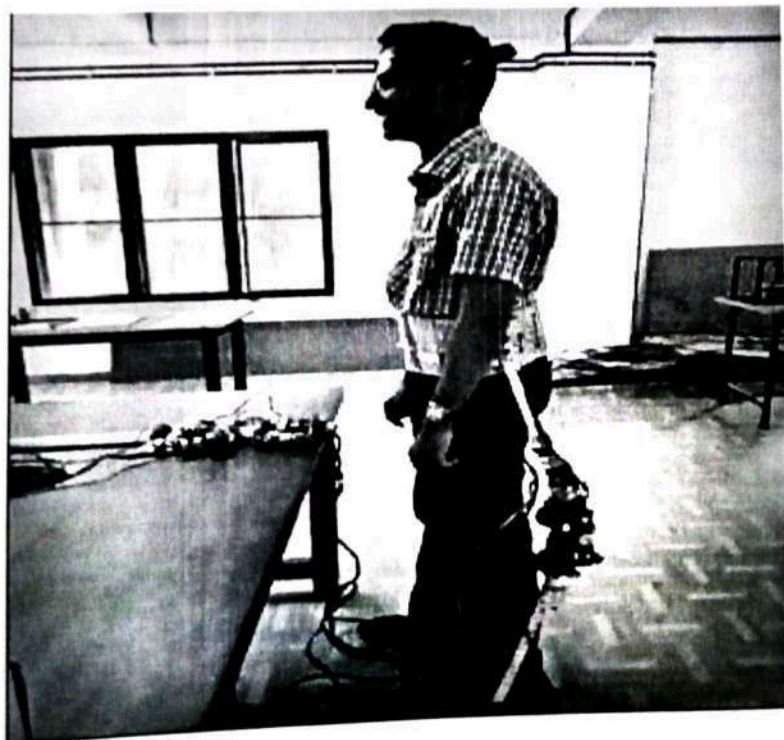

Figure 2. Designed EEG Sensor with elect
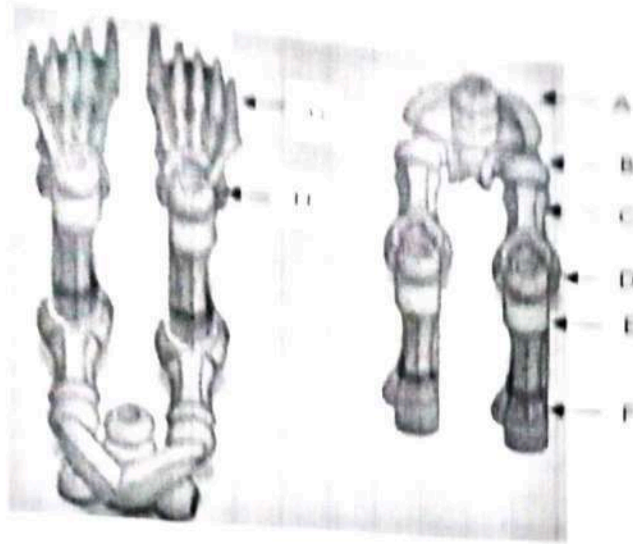
Figure 3: Complete Lower body part exoskeleton (3d Model designed)

FIGURE 4. Artificial Skin along with processor and sensor circuit

FIGURE 5.Controlling the outer structure of exoskeleton using EEG headset
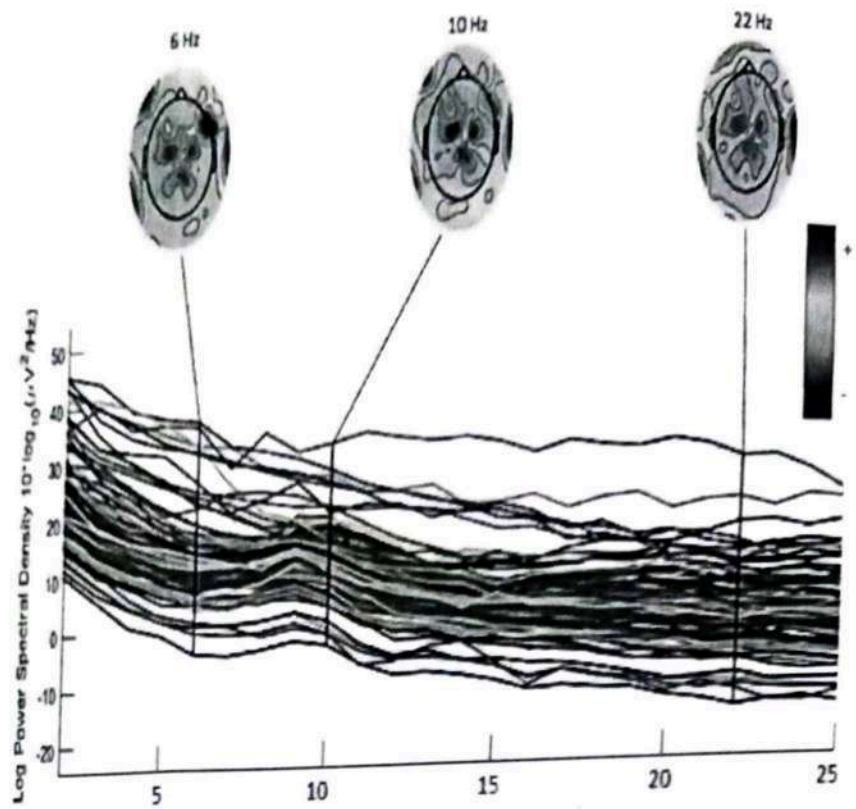
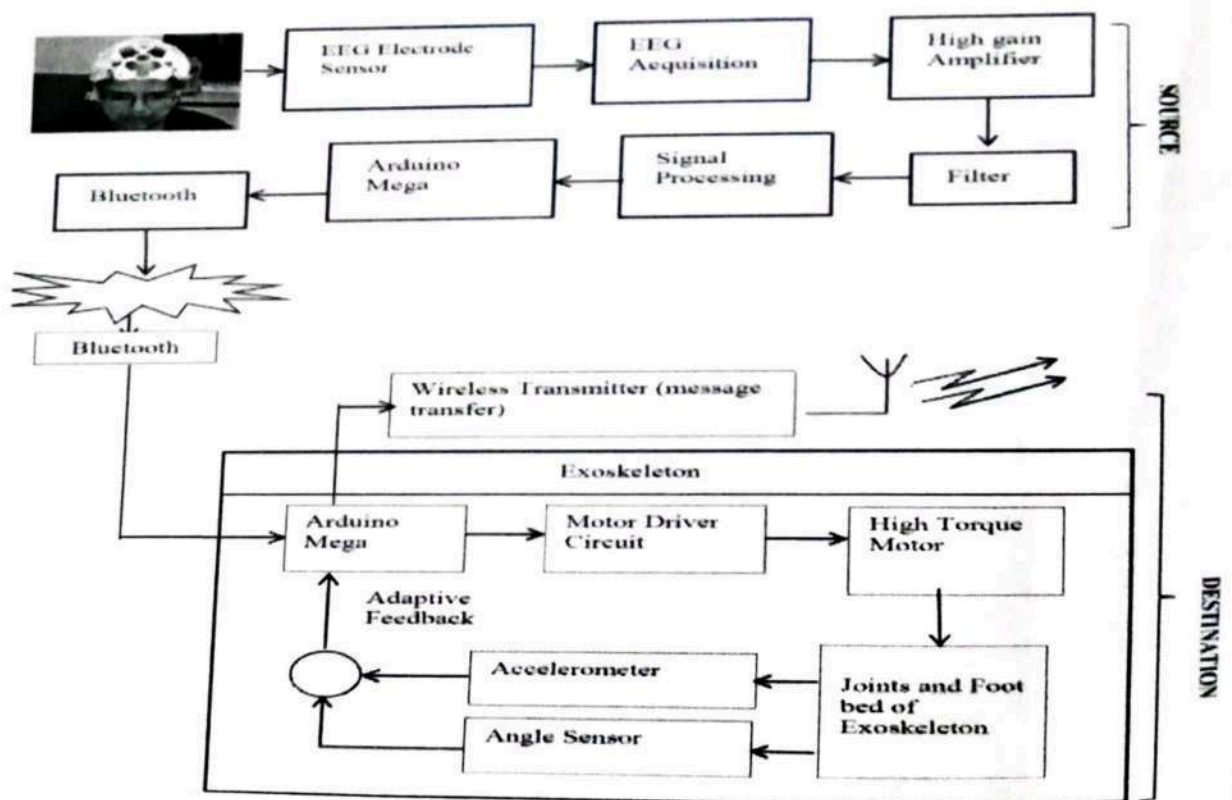**FIGURE 6. Brain pattern variations at different frequencies**

FIGURE 1 System architecture of Brain Actuated Multidimensional Exoskeleton

12. Detailed year wise work plan (Indicate methods / Techniques to be used)

Brain Actuated Assistive Technology for the paralysed(BAATP) Project Plan for 24 months

Activity	Plan Start (months)	Plan Duration (months)	Period in Months																						
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Design of EEG sensor, Muscle stimulation Unit,Signal Contition Unit,Brain signal analysis using Realistic Head models	1	6	■	■	■	■	■	■																		
Mechanical Design of Exoskeleton,Microtroller Programming for Algorithm Implementation, Interfacing of EEG sensor and Exoskelton with Microcontroller,System Integration and Testing	7	6							■	■	■	■	■	■												
Real time data Collection and Analyses,Intergration of Artificial Muscle Intelligence,Deep-learning Model development, Online Testing using the Model	13	7													■	■	■	■	■	■	■					
Usability Testing of the integrated prototype device on paralyzed patients,Incoperating Feedback from patients and Medical Practitioners,Final Assembly and Testing	20	5																				■	■	■	■	■

13. Particulars of equipment required

    1) 3D printers
    2) CNC Machine
    3) Soldering and Drilling machine
    4) Electronics work bench
    5) Laser Cutter
    6) PCB Milling Machine,CRO,Digital Oscilloscope

14. Particulars of any other facilities required

       NIL

15. **Particulars of the facilities that will be provided by the institution where this project will be implemented**
    1) 3D printers
    2) CNC Machine
    3) Soldering and drilling machine

16. **Whether the project was submitted to any other organization for financial support**
    NO

17. **Budget Details: Estimated expenditure**

Sl No	Items	Amount (Rs)
1	Consumables **(Do not exceed 20% of the total amount)**	40,000/-
2	Equipment (For Private self-financing Colleges, 50% of the actual Equipment cost subject to the maximum of sanctioned amount shall be borne by the college)	1,40,000/-
3	Travel **(Do not exceed 10% of the total amount)**	10,000/-
4	Contingency **(Do not exceed 10% of the total amount)**	10,000/-
	Total	2,00000/- (Two Lakhs Only)

Budget Justification:

1. **Consumables** : Rs 40,000/-(Forty Thousand)

   ● EEG/EMG, Pressure,Accelerometer,gyroscope sensors,cables,Controller Boards,shields,Actuators,Motors,Batteries and Other electronic Components

2. **Equipment** : Rs 1,40,000/-(One lakh Forty Thousand)
   Rental for Equipment Like 3D printers, Laser Cutters, NC Machines, Purchase of electric Equipment like Multi-meter, soldering Iron, material for 3D printing, drill bits, Acrylic and sheets for laser Cutter

3. **Travel**: Rs 10,000/-(Ten Thousand)

   ● Travel Budget will be utilized for meeting doctors, patients and subject experts

4. **Contingency:** Rs 10,000/-(Ten Thousand)

   ● Contingency Fund is utilized for patent filing, medical committee approval, to cover risks during patient usability testing.

18. The sources of funding the project including funds from other agencies from which financial assistance is obtained/expected to be obtained, and the quantum of assistance from each agency

NIL

19. Quantum and nature of assistance expected from the CERD KTU

Financial and Technical support to implement the project

20. Name and address of the authority of Institution authorized to receive the grant

Dr.PRAVEENSAL C J,
PRINCIPAL, SCMS SCHOOL OF ENGINEERING AND TECHNOLOGY,
VIDYANAGAR, PALISSERY, KARUKUTTY, ERNAKULAM-683576
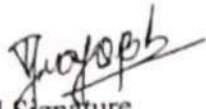
21. Whether grant under this scheme had been availed earlier by the investigator:　　　NO　　　　　　(If so, provide details)

22. Details of projects already undertaken by the Principal Investigator with any other funding agency

1. KSCSTE funded student project "Mute Horn"-A device to reduce sound pollution with a funding amount of Rs 10000/- on January 2020 as Principal Investigator
2. KSCSTE funded student project "Wearable device for detection And Prevention of Heart Failure" with a funding amount of Rs 15000/- on January 2017 as Principal Investigator
3. Manorama Yuva Mastermind Funded student Project "Wearable device for detection And Prevention of Heart Failure"with a funding amount of Rs 10000/- on April 2017 as Mentor
4. KSCSTE funded student project "Bionic haptic Arm" with a funding amount of Rs 15000/- on January 2016 as Co-Investigator
5. KSCSTE funded student project "Eco-friendly Traffic Junction" with a funding amount of Rs10000/- on January 2020 as Co- Investigator

Declaration

Certified that the details furnished above are correct to the best of my knowledge and belief that the amount of financial assistance, if granted, will be utilised for the purpose for which granted within the time prescribed by CERD KTU. I also undertake to abide by the rules other conditions prescribed by the grantee.

VINOJ P. G

Name and Signature
of the Investigator

Name and Signature
of the Prof-in-charge
CERD Satellite Centre

Name and Signature
Head of the Institution

DR. PRAVEENSA
PRINCIPAL
SCMS SCHOOL OF ENGINEERING

(Office seal)

KARUKUTTY
ERNAKULAM
683 582

SCMS SCHOOL OF ENGINEERING & TECHNOLOGY

Place: Karukutty

Date: 14|1|2021

KERALA STATE COUNCIL FOR SCIENCE, TECHNOLOGY AND ENVIRONMENT
An Autonomous body of the Government of Kerala

KSCSTE - Student Project entitled – **"Data abstraction of vehicles on crashing (DAVOC)"** submitted by Mrs.Hazel Elsa John, Assistant Professor, Electronics & Communication,SCMS School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576 Kerala as PI and Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahimas student investigator(s) - financial assistance - Orders issued.

Council (P) Order No366/2021/KSCSTE   Dated: Thiruvananthapuram,05/10/2021

Ref: -   1. Decision of the 64th SP Committee meeting dated December 13, 2019 on
item No. SP- 64_ (01300 /SPS 64/2019/KSCSTE)

2. KSCSTE/592/2020-SP

ORDER

Kerala State Council for Science Technology and Environment (KSCSTE) is operating a programme for supporting student projects in colleges and university departments. Mrs.Hazel Elsa John, Assistant Professor, Electronics & Communication, SCMS School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576, Kerala, has submitted a student project as PI with Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahimas student investigator(s) for financial assistance. The 64th SP Committee meeting dated December 13, has sanctioned ₹9800/-(Rupees Nine thousand and eight hundred only) for the conduct of the above said project. The PI has submitted the final report and financial statements after completion of the project.

KSCSTE has verified the submitted documents and is pleased to accord sanction for the release of ₹7249/-(Rupees seven thousand two hundred and forty nine only)towards financial assistance for the student project titled –"Data abstraction of vehicles on crashing (DAVOC)''submitted by Mrs.Hazel Elsa John, Assistant Professor, Electronics & Communication, SCMS School Of Engineering And Technology Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576, Kerala.The amount will be disbursed to **The Principal, SCMS School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576, Kerala**by means of Electronic Fund Transfer as per their bank details given below.

Beneficiary Account Name	SCMS School of engineering and technology
Beneficiary Account Number(SB/CC)	345801010030000
Beneficiary IFSC code	UBIN0558885
Name of bank	Union bank of India , Palissery
Beneficiary Address	The Principal, SCMS School Of Engineering And Technology Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576 Kerala

Beneficiary Phone No.   9446763487

Beneficiary E-mail ID   praveensal@scmsgroup.org

The expenditure in this regard will be met from the Council fund **(III) Schemes and Programmes of KSCSTE - Student project scheme.**

K P SUDHEER
EXECUTIVE VICE PRESIDENT,KSCSTE

To

The Principal, SCMS School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576, Kerala

Copy to:

Mrs.Hazel Elsa John, Assistant Professor, Electronics & Communication, SCMS School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576
Kerala

Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahim, Student(s),Bachelor of Technology (BTech), Electronics & Communication, SCMS School Of Engineering And Technology, Vidya Nagar, Palissery, Karukutty, Ernakulam - 683 576, Kerala

The Cash Section KSCSTE, Auditors file, Stock File/Office Copy

Kerala State Council for
Science, Technology and Environment

16.01.2020

Prof (Dr.) K.P. Sudheer
Executive Vice President
KSCSTE, Pattom

Letter No. 01300 /SPS 64/2019/KSCSTE

Dear Mrs. Hazel Elsa John,

Sub:-Financial assistance for Student Project scheme of KSCSTE reg.
Ref:-Your application received under Student Project scheme

This is to invite your attention to the reference cited and to inform that the project proposal titled "Data abstraction of vehicles on crashing (DAVOC)" submitted by Mrs. Hazel Elsa John as PI and Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahim as student investigator(s) has been approved. An amount of 19800/- is sanctioned by the Council. The budget estimate of the project is as detailed below.

SL.NO.	ITEMS	AMOUNT(₹)
1	Consumables	8900
2	Minor equipments	400
3	Travel	200
4	Research Literature & Documentation	200
5	Others (for analysis)	100
	Total	9800

The PI has to submit the signed Terms and Conditions (as per the guidelines) and the date of start of the project within two weeks to the undersigned. The project should be completed within six months and submit the certified soft copy of the final report (in pdf to sed.kscste@kerala.gov.in), audited Statement of Expenditure and Utilization Certificate counter signed by the Head of the Institution for releasing the grant. The format for final report, SE and UC can be downloaded from www.kscste.kerala.gov.in .

Thanking you.

Yours sincerely,

Prof (Dr.) K.P. Sudheer

To

Mrs. Hazel Elsa John, Assistant Professor, Dept. of Electronics & Communication, SCMS School Of Engineering And TechnologyVidya Nagar, Palissery, Karukutty, Ernakulam - 683 576

Copy to:

The Principal, SCMS School Of Engineering And TechnologyVidya Nagar, Palissery, Karukutty, Ernakulam - 683 576

Ajmal P S,Akshay Kumar T V,Adithyan A S,Hafis Abdul Rahim, Student(s), Bachelor of Technology (BTech) Electronics & Communication, SCMS School Of Engineering And TechnologyVidya Nagar, Palissery, Karukutty, Ernakulam - 683 576

Sasthra Bhavan, Pattom P.O., Thiruvananthapuram - 695 004, Kerala State, India
Tel : 0471 - 2548200-09, EVP - 2543557, 2548222, MS - 2534605, 2548220, CoA - 2543556, 2548248
Fax : 0471 - 2540085, 2534605 e-mail : kscste@gmail.com, www.kscste.kerala.gov.in

Statement of Account

Date	Remarks	Tran Id	UTR Number	Instr. ID	Withdrawals	Deposits	Balance
25/11/2021	NEFT:Mr NOEL JOSEPH GOMEZ SBIN321329393862	S32261023	Sender No:SBIN32132939 3862			20,250.00	1,83,81,384.70
25/11/2021	UPIAB/132975335288 /CR/Mr Vyshn/IDIB/vyshnavkvi nodh	S33060966	-			200.00	1,83,81,584.70
26/11/2021	NEFT:SANIL P B SIBLN21330157518	S40833044	Sender No:SIBLN213301 57518			1,80,000.00	1,85,61,584.70
26/11/2021	UPIAB/133004295763 /CR/JOEL SAB/UBIN/954482472 7@ybl	S41498816	-			200.00	1,85,61,784.70
26/11/2021	UPIAB/133012389259 /CR/ASHKAR /SBIN/ashkarsulaiman	S41503945	-			20,600.00	1,85,82,384.70
26/11/2021	NEFT:RAZORPAY SOFTWARE PRIVATE LIMITED AXISCN01069	S43165614	Sender No:AXISCN0106 972557			1,67,650.00	1,87,50,034.70
26/11/2021	UPIAB/133014833647 /CR/SIVAPRAS/SBIN/ ht.sivaprasad@	S44432277	-			22,250.00	1,87,72,284.70
26/11/2021	WEEKEND PASS	AA784416	-			4,650.00	1,87,76,934.70
26/11/2021	MUHAMMED LAMY MTC/778	AA784416	-			30,000.00	1,88,06,934.70
26/11/2021	IMPSAB/13301680918 0/UBIN0558885/94974 63767	S46400889	-			20,600.00	1,88,27,534.70
26/11/2021	NEFT:KSCSTE SBIN421330046461	S47761762	Sender No:SBIN4213300 46461			7,000.00	1,88,34,534.70
26/11/2021	NEFT:KSCSTE SBIN421330046470	S47763606	Sender No:SBIN4213300 46470			7,249.00	1,88,41,783.70
26/11/2021	NEFT:KSCSTE SBIN421330046465	S47763873	Sender No:SBIN4213300 46465			7,441.00	1,88,49,224.70
27/11/2021	UPIAB/133145668827 /CR/RANDEEP /IOBA/8301027135@i bl	S57550805	-			20,600.00	1,88,69,824.70
27/11/2021	UPIAB/133198999762 /CR/JUNO THA/CNRB/junomathe w139@	S57612168	-			55,000.00	1,89,24,824.70
27/11/2021	UPIAB/133119088420 /CR/ABHIRAM /UBIN/abhiramkv56@ ok	S66543801	-			600.00	1,89,25,424.70

No. KTU/RESEARCH 2/4643/2020   Dated: 02.09.2021

From

The DEAN (Research)

To

The Principal

SCMS School of Engineering and Technology

Sir,

Sub:- APJAKTU - CERD - Research Seed Money Scheme - Projects Selected for funding - reg:-

I am glad to inform you that the project proposals as listed in Annexure I are provisionally selected for funding under Research Seed Money (RSM) scheme of KTU.

The expenditure should be incurred as per the sanctioned budget heads and in accordance with terms and conditions given in Annexure II. Format of MOU to be furnished by the college is given as Annexure III.

The Principal Investigators may please be directed to forward request (in Annexure II) for releasing the fund with Bank Account details. The fund will be released only after settling pending accounts of the principal investigator in CERD, if any. Any request received after three months from the date of this letter will not be considered.

Yours faithfully

Dr. Shalij P.R *

DEAN (Research)

Copy To

1. Vinoj P. G, Assistant Professor in ECE.
2. Y. K. Remya, Assistant Professor in Civil Engineering.
3. Susmi Jacob, Assistant Professor in Computer Science.

* This is a computer system (Digital File) generated letter. Hence there is no need for a physical signature.

SCMS School of Engineering and Technology

Sl.No	Name of Principal Investigator	Branch	Title of the Project	Amount sanctioned	First Installment	Second Installment	Consumables	Equipments	Travel	Contingency
1	VINOJ P G Assistant Professor	ECE	Brain Actuated Assistive Technology for the paralyzed	75,000	50,000	25,000	15,000	40,000	10,000	10,000
2	Y K Remya Assistant Professor	Civil	Geometric design consistency evaluation criteria for two lane rural combined curves	1,20,000	60,000	60,000	55,000		5000	60,000
3	Susmi Jacob Assistant Professor	CSE	ContextAuth – An implicit Authentication system for Smartphones	75,000	55,000	20,000	20,000	50,000		5,000

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Centre for Engineering Research and Development
Request for releasing RSM grant

Title of Project: Geometric Design Consistency evaluation criteria for two lane rural combined curves based on vehicle lateral stability

Date of sanction: 02/09/2021

Amount sanctioned: Rs. 1,20,000

Account No and bank details: Acc. No: 588802010007681
IFSC code: UBIN0558885 ; Union Bank of India, Palissery
Account name:- CERD RESEARCH SEED MONEY 2 4643 2020-02

Terms & Conditions for Research Seed Money Scheme

1. The amount sanctioned for the project shall be deposited in a separate joint A/c of Principal Investigator and Head of the institution where the Principal Investigator works. (Name of A/c: CERD Research Seed Money - File No.)

2. The maximum duration of the project will be three years from the date of start of the project

3. The amount has to be utilized as per budget provision under each head. It is the discretion of the University to settle amount towards the purchase of those items not clearly mentioned, if any, in the project proposal.

4. The purchase of equipments shall be in accordance with the store purchase rules. All equipment purchased will be the property of CERD and the stock entry of the items purchased shall be maintained in the College signed by the Investigator, Lab in charge and Principal. Purchase of computers/peripherals is not allowed unless specifically mentioned in the sanction order.

5. For Private self financing Colleges, 50% of the actual Equipment cost subjected to the maximum of sanctioned amount will be reimbursed by KTU if and only if the proof of remittance of other 50% is produced by the college.

6. The stock entries of consumables purchased shall also be done in the consumables stock register of College. Purchase of stationery shall be for project purpose only.
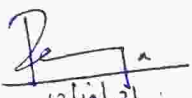
7. Books and literature purchased should be taken into the Stock Register of Central Library or Department library and then distributed to the investigators.

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8. The interest accrued will also be accounted in the project.

9. On completion of the project, detailed report of the research work (hard and soft copies), audited statement of accounts and Utilization Certificate in the prescribed format duly attested by the head of the institution shall be submitted within one month on completion of the project for settlement of accounts.

10. If the project is not completed within the time limit, the grant amount should be   reimbursed along with the interest accrued.

11. The CERD reserves the right to terminate the project at any stage if it is convinced that the grant has not been properly utilized or appropriate progress is not being made. In addition, the CERD may designate Scientist/Specialist or an Expert Panel to periodically review the work done. The Principal Investigator has to appear for the periodic review meetings.

12. If the PI to whom the project has been sanctioned, leaves the Institution, the Head of Institution/PI shall inform the same to the CERD and in consultation with the CERD, evolve steps to ensure successful completion of the project, before relieving the PI.

13. Investigators must acknowledge the CERD in reports and technical/scientific papers published based on the research work done under the project. Investigators are requested to publish some of the research papers emerging out of the project work in leading Journals.

14. If the results of research are to be legally protected by way of patent/copy rights etc. the results should not be published without action being taken to secure legal protection for the research results.

15. The knowledge generated from the project will be the property of the CERD and should be properly acknowledged. Transfer of technology generated shall be done in consultation with the CERD.

We agree to the terms and conditions stated above. Please transfer the amount to the above bank account.

13/10/21

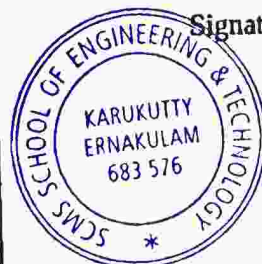Signature of Principal Investigator: Y K. Remya

Name: Y. K. Remya

Designation: Assistant Professor

Signature of Head of Institution:

DR. PRAVEENSAL C.J.
PRINCIPAL
SCMS SCHOOL OF ENGINEERING & TECHNOLOGY

SCMS SCHOOL OF ENGINEERING & TECHNOLOGY
KARUKUTTY
ERNAKULAM
683 576

2

Name: Dr. Praveensal. C.J; Principal

Office Address: SCMS School of Engineering & Technology

Vidya Nagar, Karukutty, Ernakulam— 683576

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Union Bank of India IFSC Code : UBIN0558885

KERALA
INDIA

आंध्र
Andhra

कार्पोरेशन
Corporation

शाखा BRANCH

शाखा का पता Branch Address : (SB GENERAL)

588802010007681

शाखा का फोन नं/ Branch Phone No.: M/S CERD RESEARCH SEED MONEY 2 4643 2020 02

खाता क्र. Account No.:

In the Name of :

नाम Name i) 999,SCMS ENGG COLLEGE

ii) GENEV

iii) 20-09-2021

पता Address Branch Phone No : 0484-2439029

Pin : 683576 ADEN

888,VIDHYA NAGAR

INDIA

N

पेशा Occupation

खाता खोलने की तारीख
Date of Opening A/c

नामांकन पंजीकृत / Nomination Registered : हाँ Y / नहीं N

लेखाकार Accountant

दिनांक Date	विवरण Particulars	सोल आयडी SOL ID	चेक नं. CHQ. No.	निकाली गयी राशी DEBIT	जमा की गयी राशी CREDIT	जमा कर्ता के खाते में शेष राशी BALANCE	लेखाकर आद्याक्षर INITIAL
22-03-2022	NEFT:Director of Treasuries account f473B0				60000.00	60000.00Cr	
07-04-2022	58880201007681:Int.Pd:01-01-2022 to 31-03-2022				48.00	60048.00Cr	
06-07-2022	58880201007681:Int.Pd:01-04-2022 to 30-06-2022				427.00	60475.00Cr	
17-08-2022	REMYA YK		144178	40000.00		20475.00Cr	
06-10-2022	58880201007681:Int.Pd:01-07-2022 to 30-09-2022				284.00	20759.00Cr	
03-01-2023	58880201007681:Int.Pd:01-10-2022 to 31-12-2022				144.00	20903.00Cr	