GOVERNMENT OF KARNATAKA
VISION GROUP ON SCIENCE AND TECHNOLOGY

Karnataka Science and Technology Promotion Society
Department of Electronics, Information Technology, Biotechnology and
Science & Technology

Application No.	**VRN/004648/23-24**

A. GENERAL INFORMATION

1	Scheme Applied (GRE, K-FIST L1 & L2 and ECRA)	ECRA : Early Career Research Award
2	About the project	
a)	Title of the project	"Time Series Analysis and Prediction of Groundwater Levels in Bengaluru Using Geospatial Data and Machine Learning Techniques"
b)	Subject area as per instruction (Please refer serial No.26 under Annexure-II)	Civil Engineering
	Subject category area	GIS/GPS

3	Details of Principal Investigator	
a)	Name	Dr. Naveena M.P
b)	Date of Birth & Gender (Age as on 34)	12/08/1989 (Male)
c)	Highest Qualified Degree	Ph.D. degree in Science, Mathematics and Engineering
d)	Designation	ASSISTANT PROFESSOR
e)	Department	CIVIL ENGINEERING
f)	Years of teaching/research experience	Teaching : 9.00 ; Research : 5.00
g)	Email ID	mpsnaveena@gmail.com
h)	Alternate Email ID	naveena.mp@kssem.edu.in
i)	Cell Number / Alternate Cell Number	7349093996 / 9071135404
j)	Residential Address	F4, Earthwalll Bliss, BEML 5 th stage ,RR nagar Bangalore - 560098
k)	Ph.D Degree holder	Yes (Completed)

4	Details of Co-Principal Investigator	
a)	Name	Dr. AMRUTHA DHIRAJ
b)	Date of Birth & Gender (Age as on 30/10/2019)	13/05/1984 , Female
c)	Highest Qualified Degree	Ph.D. degree in Science, Mathematics and Engineering
d)	Designation	ASSISTANT PROFESSOR
e)	Department	CIVIL ENGINEERING
f)	Institution Name	K S SCHOOL OF ENGINEERING AND MANAGEMENT
g)	Years of teaching/research experience	Teaching : 10.00 ; Research : 6.00
h)	Email ID	d.amrutha@gmail.com
i)	Alternate Email ID	amrutha@kssem.edu.in
j)	Cell Number / Alternate Cell No	9886443351 / 7975218143
k)	Residential Address	C-104, GR Heights,80 Feet Road, Royall country,8th phase JP Nagar Bengaluru, Karnataka-560083

5	Details of the Head of the Department	
a)	Name of the Head of the Department	Dr. Vijayalakshmi Akella
b)	Email ID	hod.civil@kssem.edu.in
c)	Cell Number	9845399068

6	Details of the Institution of PI	
a)	Name of the College/Institution with address	K.S. SCHOOL OF ENGINEERING AND MANAGEMENT Address : #15/1, MALLASANDRA, OFF KANAKAPURA ROAD , BENGALURU , Bangalore North , Bangalore - 560063
b)	Type of the Institution (as per the instruction in Sl.No.29)	Private Institution
c)	Accredited year by NAAC/NBA	2021
d)	Name of the Head of the Institution	K S SCHOOL OF ENGINEERING AND MANAGEMENT
e)	Designation of the Head of the Institution	PRINCIPAL
f)	Phone Number (Landline) and college website	919900710055 Website : https://kssem.edu.in/
g)	Cell Number	9900710055
h)	Email ID	principal@kssem.edu.in
i)	Student strength	

Sno.	Department	UG	PG
1	Civil Engineering	80	10
	Total	80	10

	Whether the project involves collaboration with research institution / industry? If yes , please enclose a letter to this effect	No
7	If your proposal is selected,	
a)	Cheque/DD to be written in favour of	K S SCHOOL OF ENGINEERING AND MANAGEMENT

8	If, amount to be credited to your bank	
a)	Name of the Account holder	K S SCHOOL OF ENGINEERING AND MANAGEMENT
b)	Name of the Bank	AXIS BANK
c)	IFS Code	UTIB0001513
d)	SB A/c Number	911010055761116
e)	Address of the Bank	No 75/A, Ganapathy Raja Enclave, 100 Feet Ring Rd, Gangadhar Nagar, Phase 6, J. P. Nagar, Bengaluru, Karnataka 560078

9	Details of VGST/ Other Grants	
a)	Received by Department in last 5 Years	
i)	Project Sanctioned to the Dept. from VGST in the last 5 years	Dynamic Analysis and Retrofitting of Heritage Buildings in South India" 2019, KFIST L1, 481, Rs. 10 Lakhs
ii)	Project Sanctioned to the Dept. from Other Agencied in the last 5 years	nalysis of Ground Water Potential Zones using electrical I 5 years Resistivity REmote Sensing and GIS Techniques" 2019, . Competitive Research Grant by VTU, VTU/TEQUIP I 3/2019//321, Rs 1.5 Lakhs
b)	Recieved by PI in last 5 years	
i)	Project Sanctioned to the PI from VGST in the last 5 years	NIL
ii)	Project Sanctioned to the PI from Other Agencies in the last 5 years	Science and Engineering Research Board,2022,1,10,000
c)	Received by Co-PI in last 5 Years	
i)	Project Sanctioned to the Co-PI from VGST in the last 5 years	NIL
ii)	Project Sanctioned to the Co-PI from Other Agencies in the last 5 years	Science and Engineering Research Board,2023,1,10,000

a) We are aware of all instructions and directions indicated in <u>Guidelines, Terms and Conditions (GTC)</u> present in GRD – Book of VGST.
b) We undertake to utilize the VGST grant by strictly adhering to the GTC of VGST.
c) We undertake the responsibility of purchasing/procuring the equipment only within the VGST approved cost/price.
d) If we purchase the equipment more than the VGST approved cost the college management will meet the extra cost.
e) In case of <u>transfer/ retirement/ deputation/ termination/ change of work place</u> from this Grantee Institution, we shall obtain NOC from VGST office by suggesting another responsible & suitable faculty member as PI who belongs to the grantee Dept. of this College/ Institution.
f) We will procure the equipment within the allowed cost as approved by VGST in the Budget Estimate (PART - A of GRD).
g) We will not procure any equipment which is not approved by VGST. If such procurement of Equipment/Item is made without the VGST's approval, the College Management/ Grantee Institution will bear the cost of the equipment/Item.
h) While procuring the equipment, Purchase Committee will follow the procurement procedure as per the KTPP Act 1999 & 2000. indicated in PART-A of GRD only
i) We will obtain the VGST approval of the Budget Estimate (both Non-recurring & Recurring) indicated in PART-A of GRD once in a Financial Year (FY) & we will not submit for the revised Budget Estimate. We will submit to VGST all the necessary Purchase documents (PART-B) within the 4 months period from the date of issue of grant. We will submit quarterly progress report and consolidated report at the end of the project.
j) We hereby declare that the details furnished above are true to the best of our knowledge
k) We understand that any misinformation furnished by us will lead to the rejection of the application.

(Dr. Naveena M.P)

Signature of the
Principal Investigator

(Dr. AMRUTHA DHIRAJ)

Signature of Co-
Principal Investigator

Signature of Head of
the Department
(with seal)
Professor & Head
Dept. of Civil Engineering
K.S. Group of Institutions
K.S. School of Engineering & Management
Bangalore-560 062.

Signature of the Head
of the Institution
Dr. K. RAMANARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

Attached documents

S No.	Document Name	File Name	Document Description
1	Duly Signed & Scanned Copy of Endorsement from the Head of the College/Institution	Endorsement by Head of Institution.pdf	Endorsement signed Copy by Head of Institution and Institutional Support Document
2	Part-A	PART A DOCUMENT.pdf	Signed PART A document
3	PAN Card Copy	PI & CO PI PAN CARD.pdf	PI & CO PIPAN CARD
4	Highest Qualified Degree Certificate	PI & CO PI Ph.pdf	PI & CO PI Ph.D. Degree Certificate
5	Duly Signed & Scanned Copy of Undertaking from Principal Investigator And Co-Principal Investigator	Undertaking Form.pdf	Undertaking Form Signed by PI and CO pi
6	Others	Work Plan and Milestone.pdf	

B. DETAILS OF THE PROJECT PROPOSAL

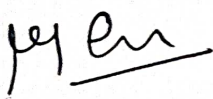|	
1. Title of the Project Proposal	Time Series Analysis and Prediction of Groundwater Levels in Bengaluru Using Geospatial Data and Machine Learning Techniques
2. Project Keywords	Ground Water , GIS,Remote Sensing, Machine Learning
3. Objectives of the proposal (Not more than six points)	1. To analyze the spatial distribution and temporal trends in groundwater levels over 5 decades through remote sensing images 2. To assess the impact of land use, soil type, rainfall, and temperature on groundwater level. 3. To create machine learning models to predict future groundwater levels based on historical data and geospatial variables. 4. To develop a decision support system for sustainable groundwater management
4. Background of the project	Groundwater is a crucial natural resource, especially in urban areas where it is a primary water source for drinking, agriculture, and industrial purposes. In Bengaluru, rapid urbanization and population growth have led to significant changes in land use and water consumption patterns. Consequently, there is a growing need for effective management and prediction of groundwater levels to ensure sustainable water resources.
5. Methodology (Graphs, designs, charts, may be attached as a separate file in the list of attachments by selecting Document Type 'Others')	1. Analyze the spatial distribution and temporal trends in groundwater level using geospatial analysis tools to map groundwater level and identify patterns, and time series analysis technique to detect trends and seasonal variation. Employ statistical and visual methods to interpret the results, highlighting the area's significant change over time. 2. Evaluate the Impact of land use, soil type, rainfall, and temperature on groundwater level by integrating these variables into a regression or machine learning model. 3. Develop a machine learning model by first collecting and pre-processing historical ground water and geospatial data, by model training, validation, and evaluation. 4. Develop a decision support system for sustainable groundwater management by integrating a predictive model. It helps to understand the trends and forecast future levels.
6. Milestones with time schedule & work plan	A separate document is Attached
7. List of equipment available in your Institute/College for the project implementation	GPS Devices Core cutter for soil-type testing QGIS
8. List of equipment required for 1st instalment & 2nd instalment for Project Implementation	1st installment Digital Water Level Recorders (DWLR) Satellite Imagery Purchase GPS Devices 2nd Installment Satellite Imagery Purchase Arc-GIS R Studio workstations
9. Relevance, importance & application of the project	This project is crucial for sustainable water resource management in Bengaluru, enabling proactive measures against water scarcity through accurate predictions of groundwater levels. It aids urban planners, agricultural managers, and municipal authorities make informed decisions to balance water demand with sustainable usage. Additionally, it enhances climate resilience and supports environmental conservation by integrating geospatial data with advanced machine-learning techniques.

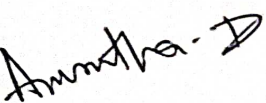|	
10. Novelty/Uniqueness of the project	The project uniquely combines historical groundwater data with geospatial information such as land use, soil type, and topography, enhancing the accuracy and reliability of groundwater level predictions. Employing cutting-edge machine learning techniques, including time series analysis and algorithms like LSTM (Long Short-Term Memory) networks, the project offers innovative approaches to forecasting groundwater levels, surpassing traditional methods in precision and adaptability. By providing a holistic understanding of both temporal and spatial factors influencing groundwater dynamics, the project offers a multifaceted solution that addresses the complexities of groundwater management in an urban context like Bengaluru.
11. Whether this project leads to innovations and patents, if yes explain	No
12. Whether this project leads to a Startup, if yes explain	NO
13. Whether this project leads to cost effective Technology, if yes explain	Overall, the integration of advanced data analytics and machine learning techniques in this project ensures that the initial investment is offset by the long-term savings and benefits derived from sustainable groundwater management and resource optimization.
14. Highlight reasons in FIVE sentences or less, what is special, unique or novel in your project that makes it an attractive proposition	The project "Time Series Analysis and Prediction of Groundwater Levels in Bengaluru Using Geospatial Data and Machine Learning Techniques" is unique due to its integration of advanced time series analysis with geospatial data to monitor groundwater levels. It leverages machine-learning techniques for accurate and dynamic predictions. The study addresses the critical issue of water resource management in an urban setting. It utilizes comprehensive datasets, including climatic, hydrological, and land-use data, to enhance prediction accuracy. The project aims to provide actionable insights for sustainable groundwater management and urban planning in Bengaluru.
15. Deliverables of the project (Precise and in bullet form)	Developed machine learning models for predicting groundwater levels in Bengaluru using geospatial data. Comprehensive analysis of temporal trends and spatial patterns in groundwater levels. Recommendations for sustainable groundwater management based on predictive insights.
16. Please state willingness of your Institute to give partial financial support to this proposal. If yes, state percentage of the total cost that will be supported by your Institute. Include a signed letter from the head of the institute assuring the said support	Yes,5 Percentage
Information about Principal Investigator, Research track record, Innovation in the proposed work	
a) List of Publications (For the last 5 years with DoI Numbers) i) Journal Publications listed @ SCImago Journal Rank (Rating . Q1 OR Q2 OR Q3 OR Q4). Specify rating by referring the website: https://www.scimagojr.com/journalsearch.php	
	Naveena M.P, G Narayana. Properties of Natural and Alkali Activated Coarse Aggregate. Gongcheng Kexue Yu Jishu Advance Engineering Science.2022;54: 5519-5529. https://advancedengineeringscience.com/article/514.html-Q3
	Naveena M.P, G Narayana. Alkali Activated Coarse Aggregate using Pelletization Technique, Neuro Quantology .2022;20:1443-1445.doi 10.14704/nq.2022.20.13.NQ88178 -Q3
	Naveena M.P, G Narayana "Study on strength and durability properties of fly ash aggregates concrete", Indian Concrete journal.2017,91:71-79 https://www.icjonline.com/editionabstract_detail/062021 -Q3
	Naveena M.P Investigations of Common Effluent Treatment Plant Sludge-based Controlled Low-Strength materials. Journal of Scientific & Industrial Research 2020,79,453-456. https://nopr.niscpr.res.in/bitstream/123456789/54693/1/JSIR %2079%285%29%20453-456.pdf -Q2
ii) Journal publications -Not listed in SCImago Journal rating rank	

	Naveena M.P, G Narayana. Experimental Study on Alkali Activated Fly Ash and GGBS Based Coarse aggregate, I manger's Journal of Civil Engineering,2022, 12: 23- 30, 42,https://doi.org/10.26634/jce.12.1.18480
	Naveena M.P, G Narayana "Alternative Fine and Coarse Aggregates in Concrete: A Review", I manger's Journal of Civil Engineering,2022,12:35-42,https://doi.org/10.26634/jce.12.1.18480
	Naveena M.P, G Narayana. Experimental Investigations on Mechanical Properties of Alkali Activated Coarse Aggregate in Concrete. SSRG- International Journal of Civil Engineering,2022,9:1-6.https://doi.org/10.14445/23488352/IJCE-V9110P101
iii) Conference Presentations	
	"Experimental Investigations on SCC with Indigenously Developed Geopolymer Aggregates" Lecture Notes on Multidisciplinary Industrial Engineering, Springer Nature Singapore Pvt Ltd. 2020, https://www.springerprofessional.de/en/experimental-investigations-on-SCC-with-indigenously-developed-g/17938554
	B.N Skanda Kumar , M.P Naveena. "Experimental Studies on Controlled Low Strength Materials Using Black Cotton Soils and Comparison of Results with Taguchi Model. Springer Lecture Notes.2020.483-494. https://link.springer.com/chapter/10.1007/978-981-15-0890-5_40
	Naveena M.P, G Narayana "Study on Flexural Behaviour of Reinforced Concrete Beam By Incorporating Cement Bonded Fly Ash Aggregate To Natural Aggregates", Structural Engineer World Congress, Istanbul, Turkey
iv) Google Impact factor of journal	0.5
b) Patent(s) filed/granted with details	Patent Filed- Development of Geopolymer Aggregates Design Patent Granted - Solar Powdered Cold Room
c) Give details of commercialization status for the granted patents	Solar Powdered Cold room design needs to be commercialized
d) Books published/chapter contributed with details	NIL
e) Industrial consultation (given/undertaken) provide details (past 5 years)	1. Structural Design Auditing of School buildings and Residential buildings. 2. NDT testing of residential and commercial buildings
f) Highlight reasons in FIVE sentences, why your project must be chosen over many other proposals received by VGST?	This project stands out due to its direct relevance to addressing critical water management challenges in Bengaluru, a rapidly urbanizing city facing groundwater depletion. By integrating geospatial data and machine learning techniques, it offers advanced predictive capabilities crucial for sustainable urban planning and resource allocation. Its potential impact on mitigating water scarcity underscores its importance amidst growing environmental concerns in urban areas.
g) Have you tested your concept/innovation? If yes indicate supporting results that makes you to believe in the succusses of the proposal	Yes, a preliminary field study of ground water level has been carried out in Rmanagara District using an electrical resistivity approach. Hence to overcome the difficulties this project proposed.
Information about Co-Principal Investigator, Research track record, Innovation in the proposed work	
a) List of Publications (For the last 5 years with DoI Numbers) i) Journal Publications listed @ SCImago Journal Rank (Rating . Q1 OR Q2 OR Q3 OR Q4). Specify rating by referring the website: https://www.scimagojr.com/journalsearch.php	
	Studies on the Effect of a Tree Pod based Natural Plasticizer on Durability Properties of Concrete", Indian Concrete Journal, Volume 97, Issue 1, January 2023, pp 31-40.
	"Experimental Studies on Slump and Strength Properties of Concrete with Natural Admixture", NeuroQuantology, Volume 20, Issue 9, September 2022, pp 6686-6690, DOI: 10.14754/nq.2022.20.9.NQ44783.

	"Effect of rain tree pod extract as plasticizer on properties of concrete. International Conference on Advances in Materials and Manufacturing Applications", Materials Today: Proceedings, Volume 46, Part 10, April 2021, pp 5182-5186,. DOI: 10.1016/j.matpr.2021.03.442
ii) Journal publications -Not listed in SCImago Journal rating rank	
	☐ "Studies on Workability of Cement Mortar and Concrete using Natural Plasticizer", RV Journal of Science Technology Engineering Arts and Management (RVJSTEAM), Volume 3, Issue 2, July 2022, pp 1-11, https://rvitm.com/RVjstream-New/pdf/03/issue-2/1.Studies-on-Workability-of-Cement-Mortar-and-Concrete-using-natural-Plasticizer.pdf.
iii) Conference Presentations	
	National Conference on Civil Engineering-New and Effective Innovations, Technologies and Key Challenges 2020, NCCE-NITK 2020, January 30th to January 31st 2020.
iv) Google Impact factor of journal	0.23
b) Patent(s) filed/granted with details	NIL
c) Give details of commercialization status for the granted patents	NIL
d) Books published/chapter contributed with details	NIL
e) Industrial consultation (given/undertaken) provide details (past 5 years)	NIL
Details Of Industrial Collaboration	

Signature of PI and Co-PI

Signature from Industry/Collaborative Institute
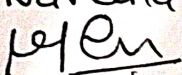
1) _[signature]_

2) _[signature]_ Anantha-D

C. UNDERTAKING FROM THE PRINCIPAL INVESTIGATOR AND CO-PRINCIPAL INVESTIGATOR

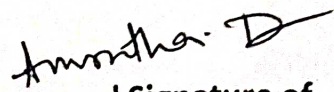| Project Title:	"Time Series Analysis and Prediction of Groundwater Levels in Bengaluru Using Geospatial Data and Machine Learning Techniques"
VGST Scheme:	Early Career Research Award

1) We have carefully read the terms and conditions of VGST Scheme and we agree to abide by them and complete the project by fulfilling all the formalities.

2) We have not submitted or obtained any financial support for this or a similar project proposal.

3) We shall ensure that the equipment shown in the project proposal which will be procured under this project are not available in our institution/college.

4) The equipment procured under VGST Scheme will be made available to other faculty and students, as needed by them.

1) We hereby declare that the details furnished above are true to the best of our knowledge.

2) We understand that any misinformation furnished by us will lead to the rejection of the application.

Dr. Naveena M.P

Name and Signature of the

Principal Investigator

Dr. AMRUTHA DHIRAJ

Name and Signature of

Co-Principal Investigator

Date: 20.06.2024