



INSPIRE Nepal

STEM for Social Impact

DECEMBER 15

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V00996378



STEM FOR SOCIAL IMPACT



Project Implementation Report

Effective Community Engagement Methodology in Software Development

Background

INSPIRE UVic is a program of research and community-based innovation at the [University of Victoria](#) (Uvic, located Victoria, BC, Canada) that engages Engineering and Computer Science students with the help of mentors from industry and the community to ideate and co-create solutions that address society's most pressing challenges, especially in the area of sustainability.

The Director of the program, [Dr. Daniela Damian](#) is an accomplished researcher and a Professor of Software Engineering at the University of Victoria. Dr. Damian has already attracted significant support from industry, the community and UVic, totaling about \$2 million in funding. The largest funder is IBM, which is contributing \$500,000 over five years, marking the first time the company has supported a Canadian university in following its Apprentice Garage model. INSPIRE has already attracted 30 industry and community partners and is currently working on [6 projects](#) with over 30 students, as of 2022.

After a successful on-going program this year, INSPIRE is exploring the possibility to expand in Nepal in collaboration with Center for Asia Pacific Initiatives – a research center in the university, and is searching for a community partner in Nepal to achieve the following objectives:

- To provide students in STEM fields with an opportunity to experience real world project that has a potential for deeper impact in sustainability while training them with soft and professional skills.
- Help community partner accomplish a project that is of a benefit to the organization.
- Help the community partner identify and possibility retain talent from the team that works with them.

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- Establish a partnership with a non-profit organization in Nepal to help achieve INSPIRE’s mission in Asia – STEM for Social Impact in a developing country like Nepal.
 - Establish a three-way partnership with a local technology company with INSPIRE and community partner for maintenance and scaling of the developed projects.
 - To identify and nurture research potential in students to prepare them for graduate studies at UVIC in helping raise a generation of competent scientists.

Under the arrangement of INSPIRE project in Nepal, Kathmandu Codes has signed an agreement with INSPIRE. INSPIRE Nepal and Kathmandu Codes has selected four students studying in their final year of Computer Science/Engineering from Islington College and Tribhuvan University Institute of Engineering to be part of Inspire Nepal, to work with Tearfund Nepal in developing the software. [Mr. Bachan Ghimire](#) is one of Dr. Daniela Damian’s Graduate Research students in Computer Science, University of Victoria. While in Nepal, he worked in the capacity of a Chief Technology Officer and has over five years of entrepreneurial experiences. His past education in Computer Science (BSc) and Project Management (MSc) along with his experience gives him a solid foundation in establishing partnerships and executing technical projects, thus motivating him in launching the INSPIRE program in Nepal.

This specific program has two-fold mission: The first is to provide students opportunities to gain hand-in experience in developing software based on the Community partners need; and the second is to develop a product (software) that will benefit Tearfund to gather, manage and analyze the program data in an effective, efficient, and accurate way. Based on the mutual understanding between Tearfund Nepal leadership and Bachan Ghimire, the coordinator of INSPIRE Nepal, and the understanding between him and CEO of Kathmandu Codes, an MoU has been prepared and signed to document understanding about the purpose of the product, the deliverables and future maintenance of the product.

The Community Partner: Tearfund Nepal

Tearfund has been working in Nepal since 1970 and is currently partnering with eight organizations across the country. It is also one of the Scottish Government projects being implemented in Nepal. Tearfund received funding in 2017, through the Scottish Government's Humanitarian Emergency Relief Fund, to respond to flooding in Nepal. Following the devastating floods in Nepal in August 2017, the Scottish Government gave Tearfund £100k to implement an early recovery project in Banke District, one of the worst hit districts in the country. Following the earthquakes in 2015, Tearfund launched an emergency aid operation and was one of the first agencies to rebuild permanent, earthquake-resilient homes. The National Reconstruction Authority of Nepal is using Tearfund's shelter approach as a model for all the earthquake-affected areas in the country.

According to the report based on the Nepal Multiple Indicator Cluster Survey Report (NMICS) 2019, the Multidimensional Poverty Index (MPI) value of Nepal in 2019 was 0.074. It was deduced that the number of schooling years and nutritional deprivations contribute most to ongoing multidimensional poverty in Nepal. And so, with the objective of tackling the challenges of poverty as well as mitigating its negative repercussions, Tearfund, an International Non-Governmental Organization, has been working in Nepal for over five decades. Tearfund has collaborated with partners in constructing homes, building water systems, teaching valuable and practical life skills, and protecting marginalized people such as women and people from lower castes.

Team Formation

Four Apprentice Garage (AG) members, after a thorough recruitment process, were selected for the INSPIRE Nepal program. Kathmandu Codes Pvt. Ltd., a software company based in Kathmandu, helped in recruitment of the AG members. Kathmandu Codes also provided the AG team with workspaces, official accounts, licenses, and resources. The company was responsible for legal formalities of hiring the AG team members. With the help of senior developers from the company, the team got an opportunity to learn from industrial practitioners through day-to-day office experience. Two mentors generously guided the team through the project in both technical and administrative/business aspects of the project.

Table 1: Team Formation

Role	Individual	Affiliation
Program Director	Dr. Daniela Damian	Professor, Computer Science, Univeristy of Victoria
Coordinator	Bachan Ghimire, MSc	Ambassador, INSPIRE CTO, Kathmandu Codes Research Assistant, UVIC
Technical Mentor	Er. Pream Shilwal	Senior Software Engineering Consultant
Business and Relations Mentor	Tandin W. Sherpa, MBA	CEO, Kathmandu Codes
Apprentice Garage Team Members	Aarjan Ghimire, Ashma Rai, Krischal Dhungel, Suprant Shrestha	Final year computer science/engineering students
Industrial and Workplace Mentorship	Dibas P. Joshi, BSc, Er. Season Maharjan	Department Heads, Kathmandu Codes

Introduction to the AG Team

“AKAS (आकाश) translates to ‘sky’ in English. They say, ‘Sky's the limit’, which correlates to our case as we would like to signify that our capability knows no bounds, and thus the name AKAS.”



Figure 1: From left to right: Suprant Shrestha, Ashma Rai, Aarjan Ghimire, Krischal Dhungel

Aarjan Ghimire

“Aarjan is a final-year student in bachelor’s in computer engineering at IOE, Tribhuvan University. He has a keen interest in enterprise software development. Outside of engineering, he loves reading different books and articles. He enjoys his time writing random pieces of code, playing video games, and listening to songs in different languages. He loves to share what he knows and learn what interests him.”



Krischal Dhungel

“Krischal is a final-year student currently enrolled in the Undergraduate program at London Metropolitan University in Computer Science. He is a bright individual with a knack for learning and adaptive problem-solving skills. With an interest in fiction, music, and gaming, he can be an interesting individual to interact with.”



Ashma Rai

“Ashma is a final year student of bachelor’s in computer engineering at the Institute of Engineering, Tribhuvan University; she aspires to be not just a programmer but also a creator, designer, and hopefully a successful artist. Building her confidence, competency, and proficiency along with her team, her soul is fueled with an ambition to contribute to her country and has faith that one day, she shall become someone that is received as a zealous girl with determination to emerge from her world of Kafkaesque.”



Suprant Shrestha

“Every person is unique in his own way’ as said by the famous poet Milton. Suprant Shrestha is a student of BSc. Computing in London Metropolitan University. He is a creative individual who has a unique perspective to look into life. He is a calm person and likes to solve problems in the best way possible. He is passionate about designing and wants to learn more about web development. He has also organized a futsal tournament called NFCL in Nepal. He is currently a member of an AKAS team at INSPIRE and is grateful to be a part of it.”



Trainings and Workshops

An inseparable component of the INSPIRE Nepal project were workshops and trainings provided to the AG team by several experts in their respective fields. The facilitators of the workshops were carefully selected upon through consideration. The following table summarizes the workshops that took place during the program.

Table 2: Trainings & Workshop

Sessions	Week	Facilitator
Introduction of Program	1	Dr. Daniela Damian
Professional Conduct & Accountability	1	Dr. Dhruba R. Ghimire
Agile Methodology & Project Management	2	Ashish Pathak
Dealing with Clients and Partners	2	Tandin W. Sherpa
Equity, Diversity, and Inclusion in Workplace	2	Dr. Dhruba R. Ghimire
UI and UX Design	4	Mibis Shrestha
Requirements Engineering	4	Bachan Ghimire
Cross-platform Mobile Development	5	Season Maharjan
API Design and Relational Databases	3	Dibas P. Joshi
Entrepreneurship	6	Saharsha Khatri
Recurring Activities		
Sprint Planning	Mondays / 2 weeks	Supervisor
End of Iteration	Fridays / 2 weeks	Bachan Ghimire
Weekly Reflections	Fridays/ week	Team/ Supervisor

The Problem and Solution Objectives

Tearfund makes a difference in numerous lives every day, helping people escape the negative effects of poverty and disaster and relieving the impacts of these disasters. But the question remains, 'How significant are these differences?' An immense impact was made by Tearfund in each beneficiary's life, but it was left unaccounted for and without proper visualization. Dr. Dhruba Raj Ghimire, a leading researcher in Rural Development field in Nepal, conducted research with the University of Bath (UK), and Tearfund to produce several recommendations among which one in particular focused on need of improvement of monitoring systems, data management systems and evaluation tool for Tearfund. One of the ways to improve the data management was by building a software where thousands of data could be visualized and monitored.

'Identifying the aspects that require transformation is necessary, but understanding the significance held by such transformations and hence amending those aspects is essential.' Apprehending this fact, the project Tearfund Nepal Community Transformation Dashboard concentrates on visualizing the impacts held by Tearfund's projects which are based on the data accumulated from each Tearfund project. The project shall contribute to the identification of strategic policies adhering to Sustainable Development as well as progress tracking. The team 'AKAS', is therefore aiming to developing a comprehensive, full-stack web-based application with the following objectives:

- Help Tearfund visualize the impact on the communities as a result of their programs implemented in rural areas of Nepal.
- Help partner networks autonomously manage their respective community data.
- Keep track of available trainers for Disaster Risk Reduction (DRR) in Nepal.
- Assist in creating organization strategies based on numbers and figures.
- Compare baseline and in-line community health indicators.
- Accumulate, aggregate, and analyze data from all programs conducted by the organization.
- Manage a pool of human resource.
- Manage pool of program themes, activities, file resources.
- Secure file and resources management.

Implementation Challenges

INSPIRE Nepal project was not immune from challenges, like any other experimental projects. From setting up the team to practicing community engagement, there were several talking points that came up during the implementation.

Software Development: Most charity organizations do not have technology at their core for the problem they are trying to solve. Tearfund was of no exception. This results in the organization not having too many people from a technology background. Collection of requirements, use of shared vocabulary and designing interfaces were challenging because of this. Also, community partner not having infrastructure for deployment makes it harder to plan usage and scaling up.

Shared Understanding and Expectation Management: While discussing requirements, and exploring them, what the client expects might not always align with what the student team is envisioning. This has also seen to be a recurring pattern in previous INSPIRE projects. The community partner might not have an idea of the efforts and time required to develop such a solution, which might lead them to thinking more can be done in less time, as opposed to the reality.

Time Management: While for the Apprentice Garage team, the project is their full-time work, and theoretically give all their time and efforts into it, that might not necessarily be the same for the community partner. This is an issue, because (a) this can result in untimely communication/gaps and (b) the priority and usefulness of what is being developed can be second guessed.

Team Management: Finally, from the perspective of managing an Apprentice Garage team, a key challenge lied in making sure that all the members have the same pace of learning. Granted that not everybody has the same learning curve, but it is necessary that the facilitators understand and recognize if anybody is lagging behind. Additionally, the team members not having the same level of technical competency should be carefully tackled so that nobody feels less important than their peers.

Community Engagement Opportunities

In South Asian context, developing countries are home to many hundreds of non-profit organizations focused on community and rural development. All of these organizations leverage data from their respective program sectors. That provides spaces for social innovation.

Social Innovation: Community-engaged software development methodologies presents opportunities for social innovation. Often times, social innovation is as simple as implementing innovative practices to improve solutions that already exist, and have it upgrade with use of technology in order to meet the needs of a society. INSPIRE Nepal is an example of how a software can help social workers manage their existing pool of data, from which important insights can be drawn.

Social Enterprise: Additionally, community engaged methodologies often prompt the Apprentice Garage teams with opportunities to expand their products/solutions into a broader 'start-up' concept. Past INSPIRE projects have opened up doors for funding opportunities and connections with policy makers. Several start-up ideas are produced as a result of a team working together with a common goal, as implemented in INSPIRE Nepal project.

Strategic selection of Community Sectors: INSPIRE having implemented over-a-dozen community engaged projects, one of the recommendations from the Nepal wing projects is to be strategic when it comes to selecting community partners, especially in the context of future projects in South Asia. With INSPIRE's goal of "STEM for Social Impact" in mind, organizations working in critical sectors such as Water Supply and Sanitation (WASH), Education, Health and Agriculture can be considered. Several countries in South Asia, namely Nepal, has over 70% of the population working in agriculture. Social innovations in this sector will have higher impact due to the demographics. Additionally, health and education sectors can use community engagement innovation methodologies, as the country can benefit from innovation opportunities such as electronic health record management systems, innovative e-learning management systems, improved agricultural technologies, and such.

Project Timeline

The project has been following the timeline as shown in the table below. The project is currently in the later phase of development, and project documentation and handover are in the pipeline to be completed in the last month of the project.

Table 3: Project Timeline

Milestone	Description	Estimated Dates
Project Proposals	Proposals sent to different organizations in order to find a suitable community partner	7 th August 2022.
Recruitment	Hiring of AG members, selection of Mentors	20 th September 2022.
Community Partner Selection	Finalizing community partner and signing an MOU document by INSPIRE, Kathmandu Codes and Community Partner.	30 th September 2022.
Project Start	Introductory sessions and establishment of communications. Team bonding exercises and setting up the environment.	1 st October 2022.
Problem Exploration	Students research an open-ended problem, look at existing solutions and produce a problem statement.	15 th October 2022.
Prototyping	The team will produce prototypes (not necessary GUI prototypes) to have a proof of their concept for the solution to their problem.	1 st November 2022.
Development Phase I	The team will build their first Minimum Viable Product (MVP) and start testing the solution.	15 th December 2022.
Development Phase II	The team will build their final version of the solution with added features	30 th December 2022.

	based on test results and feedback from development phase I.	
Testing and Deployment	The team in coordination with community partner will test the software and deploy it on a secure server with the development company.	15 th January 2023.
Documentation and Handover	Students produce a technical document of their work and complete the handover process.	27 th January 2023.

A glimpse of the Solution

The biggest challenge for the project was planning how thousands of community information would be stored securely in a database. The following image is the most recent version of a schema, sample data page, and user flow developed for the project.

A complete project report is subject to be produced at the of the project.

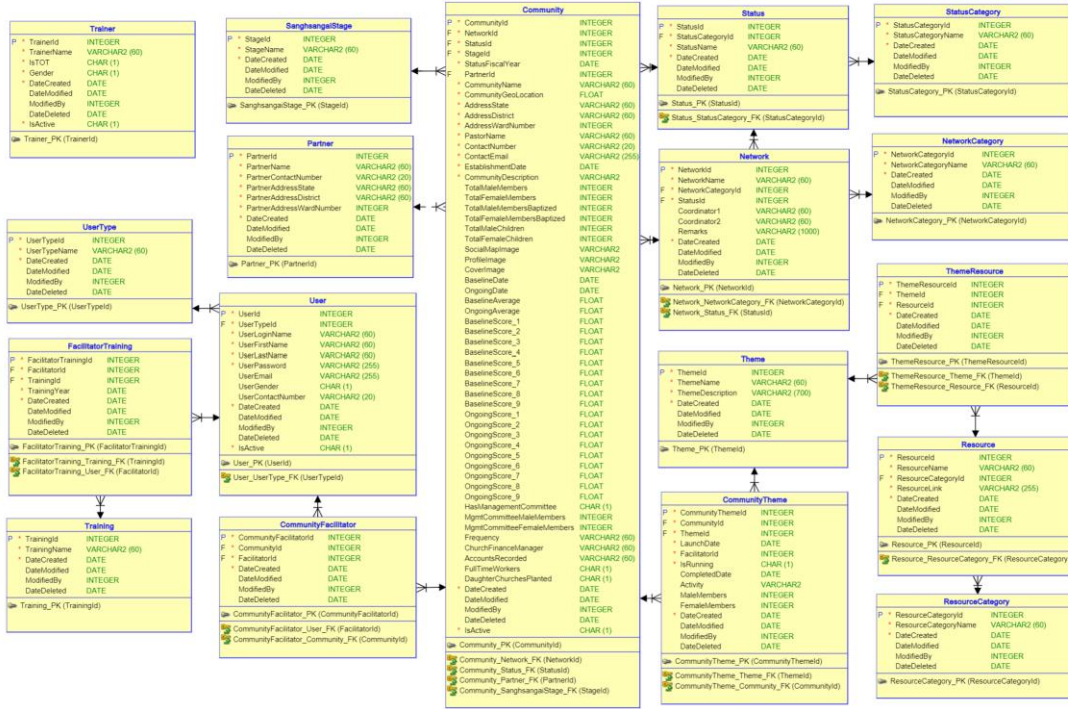


Figure 2: Entity Relationship Diagram for the proposed solution

Figure 3: Sample Data-page for the software

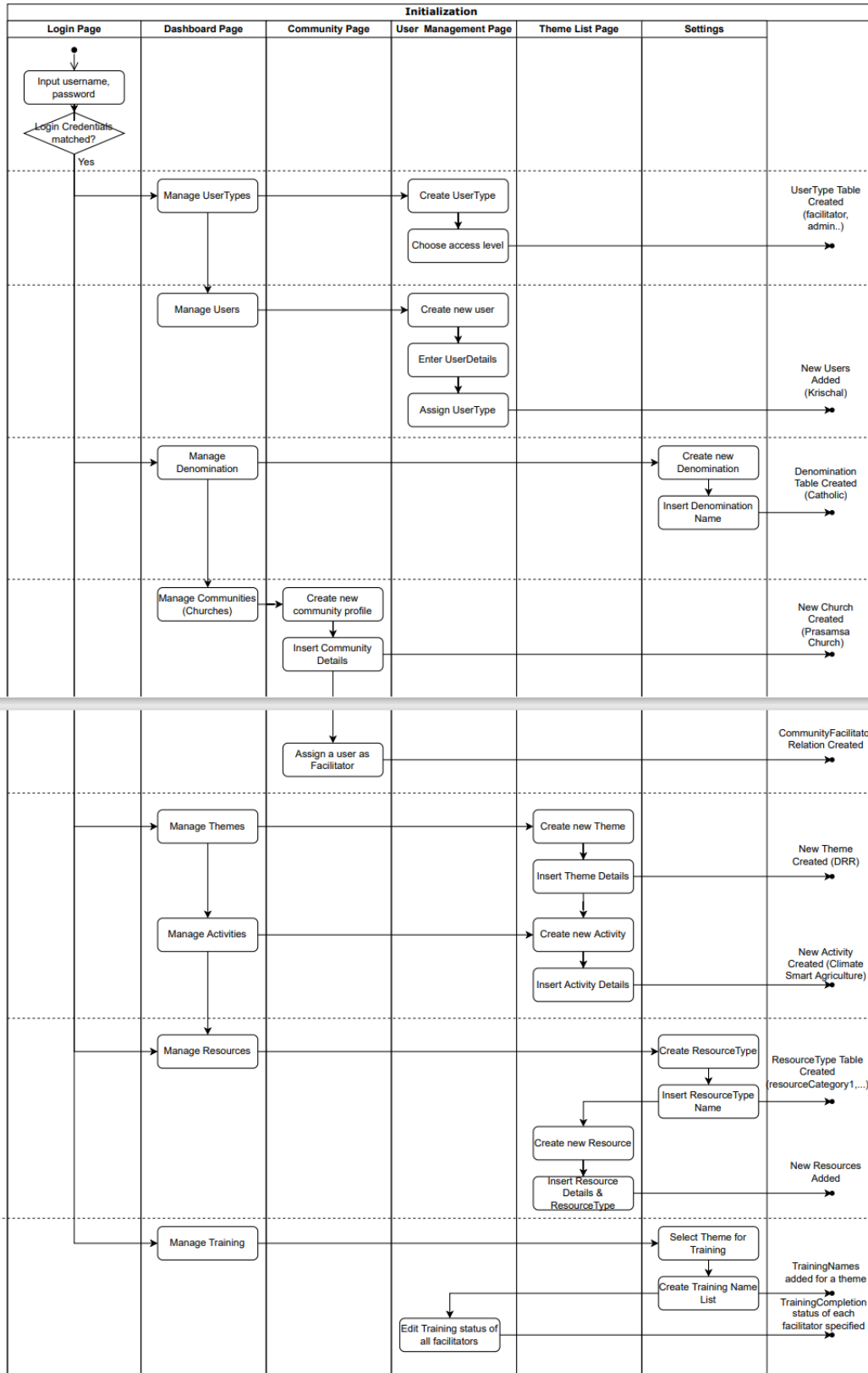


Figure 4: User Flow Context Diagram