Sri Lanka Institute of Information Technology

PROJECT REGISTRATION FORM

(This form should be completed and submitted on or before 11.55 PM, Friday 17th January 2020)

The purpose of this form is to allow final year students of the B.Sc. (Hon) degree program to enlist in the final year project group. Enlisting in a project entails specifying the project title and the details of four members in the group, the internal supervisor (compulsory), external supervisor (may be from the industry) and indicating a brief description of the project. The description of the project entered on this form will not be considered as the formal project proposal. It should however indicate the scope of the project and provide the main potential outcome.

PROJECT TITLE (As per the accepted topic assessment form)	An intelligent system for diagnosing plant disorders, causative nutrient deficiencies in soil and identifying remedies
RESEARCH GROUP **(as per the Topic assessment Form)**	**Tmp_2020_179**
PROJECT NUMBER	(will be assigned by the lecture in charge)

PROJECT GROUP MEMBER DETAILS: (Please start with group leader's details)

	STUDENT NAME	STUDENT NO.	CONTACT NO.	EMAIL ADDRESS
1	Bilal Sariffodeen (GROUP LEADER)	IT17354516	0718997616	the.sariffodeen@gmail.com
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4	K. T. Ramasinghe	IT15070418	0767009849	kavikit591@gmail.com

SUPERVISOR Details

Name	Signature	Date
Dr. Janaka Wijekoon		

CO-SUPERVISOR Details (will be assigned by the Supervisor, if necessary)

Name	Signature	Date

EXTERNAL SUPERVISOR Details (if any, may be from the industry)

Name	Affiliation	Contact Address	Contact Numbers	Signature/Date

ACCEPTANCE BY CDAP MEMBER

Name	Signature	Date

PROJECT DETAILS

Brief Description of your Research Problem: (extract from the topic assessment form)

On a global scale agriculture accounts for 39.4% of the GDP while 43% of all exports is agricultural products [1]. In the local context, the agriculture sector of Sri Lanka contributes about 7% to the national GDP [2]. Meanwhile it employees over 25% of the work-force [2]. While agriculture in Sri Lanka is dominated by rice [2] it also produces several cash crops and has a significant market share in the global production of tea. Thus, it is evident of the important role agriculture plays within the country. However, several factors owing to issues such as <>on productivity and profitability hamper the growth of this sector [2]. While plant diseases contribute to a loss in productivity a much lesser known but important impediment is the consistent availability of the optimum amount of soil nutrients.

A deficiency in the soil nutrients pose a severe threat to the growth, yield and quality of produce in the crops cultivated [3]. Such conditions give rise to plant disorders which have visible symptoms indicating the deficiency in soil nutrients. Using this knowledge, a research problem has been identified requiring an intelligent system to identify the deficiency of soil nutrients in real time. This research aims in identifying plant disorders at early stages and the soil nutrient deficiency contributing to it using image processing, IoT and recursive neural network techniques in machine learning. It also aims in providing the remedial measures that needs to be taken by the farmers through a block-chain based solution by integrating the numerous stakeholders involved. The numerous stakeholders in the sector contributes to information asymmetry [4]. To solve this problem and disseminate the most accurate information in a visible manner from the researcher to the farmer and the agro-product supplying agents, the block-chain technology is proposed.

References

[1] N. Khanna and P. Solanki, “Role of agriculture in the global economy,” *Agrotechnology*, 30-Nov--1. [Online]. Available: https://www.longdom.org/proceedings/role-of-agriculture-in-the-global-economy-15024.html#:~:targetText=Agriculture plays a crucial role,employment to their rural populations.&targetText=However, improvements in agriculture and,alleviation and overall sustainable development. [Accessed: 02-Dec-2019]

[2] “Sri Lanka - Agricultural SectorSri Lanka - Agricultural Sector,” *Sri Lanka - Agricultural Sector*. [Online]. Available: https://www.export.gov/article?id=Sri-Lanka-Agricultural-Sector. [Accessed: 03-Dec-2019]

[3] J. B. Morgan and E. L. Connolly, “Plant-Soil Interactions: Nutrient Uptake,” *Nature News*. [Online]. Available: https://www.nature.com/scitable/knowledge/library/plant-soil-interactions-nutrient-uptake-105289112/. [Accessed: 03-Dec-2019]

[4] H. Li and Dianhui Mao & Zhihao Hao & Fan Wang, “Innovative Blockchain-Based Approach for Sustainable and Credible Environment in Food Trade: A Case Study in Shandong Province, China, by Dianhui Mao; Zhihao Hao; Fan Wang; Haisheng Li,” *Sustainability*, 01-Jan-1970. [Online]. Available: https://ideas.repec.org/a/gam/jsusta/v10y2018i9p3149-d167569.html. [Accessed: 03-Dec-2019]

Description of the Solution: (extract from the topic assessment form)

Plant disorders are caused due to experiencing nutrient deficiencies and would most often lead to a depletion of crop yield.
The proposed solution aims to identify disorders in plants using image processing and associate the disorder with the relevant nutrient deficiency by employing recursive neural network based structural prediction.
Once the deficiency is identified, it is further verified by readings obtained by a device used to detect nutrient proposition in soil.
On verification, based on readings of nutrient content obtained, and data provided by research institutes and personnel, the most adequate commercial product is identified with the recommended quantity.
Once product and quantity are identified, a blockchain based system would detect most adequate seller/vendor of product and is recommended to the farmer, effectively mitigating the impact vendors have on such agricultural products and creating a distributed system.

Main expected outcomes of the project: (extract from the topic assessment form)

To Identify disorders of plants and related nutrient deficiencies and constructing a streamlined system to acquire necessary remedies for planters based on expert knowledge, mitigating the control vendors have over fertilizer-based products.

Outcomes Identified:

1. Detection of nutrient deficiency related disorders in plants.
2. Diagnosis of nutrient deficiency based on consequent disorder effecting plant.
3. Soil proposition analysis to quantitatively identify soil nutrient deficiencies to recommend adequate commercial product and quantity.
4. Creating a blockchain based distributed and secure platform for relevant stakeholders, to streamline process of adequate administering of necessary commercial products.

WORKLOAD ALLOCATION (extract from the topic assessment form)

(Please provide a brief description about the workload allocation)

MEMBER 1	M. Sukanya

Component: Positive identification and diagnosis of possible disorder.
Using image processing and supervised deep learning to identify plant type and disorder

- **a.** Using image processing techniques and unsupervised deep learning to identify plant type (from a selection of tea, corn and potato).
- **b.** Once plant type is identified the same techniques are used further to classify the nutrient disorder (from a selection of N, K, P)
- **c.** For the purpose of the above two functions a CNN is trained and semantic segmentation along with object detection is used by training a data set using unsupervised means.
- **d.** For this purpose, the technologies planned to be used are TensorFlow, android native (to facilitate mobile usage) and PIL (a python imaging library)

MEMBER 2 L. H. Rajaratne

Component: Identification of degree of disorder propagation using supervised machine learning and image processing

a. Using the further image processing and data as an input from the findings of member one, image processing and unsupervised machine learning is used further to analyse the growth phase of the leaf intelligently.
b. The degree/stage of nutrition deficiency shown in the leaf is then determined by using object identification and semantic segmentation of image processing with the aid of deep neural network to identify the specific growth phase (the degree of nutrition deficiency is varies on the growth phase of the leaf). Image processing techniques will make use of visible symptoms for the identification of the growth stage and the extent of nutrient deficiency it contains.
c. These objectives are achieved using technologies of object detection and semantic segmentation in image processing and using unsupervised learning models of deep learning and neural networks
d. Technologies such as TensorFlow written in Python will be used for this.

MEMBER 3 K. T. Ramasinghe

Component: Develop an IOT device to measure key nutrient values of soil with the usage of Arduino to verify nutrient deficiency identified through unsupervised means from member 1 and 2.

Plant disorders that occur due to nutrient deficiencies can be cause due to a lack of soil nutrients, the availability of one nutrient in excess which deprives nutrient absorption by the plant, or due to ph, temperature or climatic changes. In order to provide farmers with accurate information to tackle plant disorders soil nutrient contents are measured. Moreover, measuring the percentages of nutrient contents of soil is essential to decide how much extra contents of these nutrients are to be added in the soil to increase soil fertility. This helps to improve the quality of the soil which in turn yields a good quality crop.

a. In the proposed system Using a color sensor and a light sensor can be developed to determine nutrient values in the selected soil sample using Arduino.
b. In addition to this, pH value of the soil is determined by adding capsule to the soil solution to determine whether the soil is acidic or basic. Here colorimetric measurement of aqueous solution of soil will be carried out. The color sensor is based on the principle of absorption of color by solution. The proposed device will be calculating percentages of nutrient contents based on CMYK and RGB color intensity of soil sample.
c. Within the proposed system Nitrogen, Phosphorus, Potassium nutrient contents will be analyzed.
d. It helps in determining the nutrient amount as high, medium, low or none.
e. The sensor probe along with proper signal conditioning circuits will be developed to detect the deficient component of the soil. It is useful in dispensing only required amount of fertilizers in the soil.

MEMBER 4 B. I. Sariffodeen (Group Leader)

Component: Implement a secure and distributed platform for identifying best commercial product for deficiency based on diagnosis

Traditional trading approaches are generally employed when Farmers/Cultivators purchase Fertilizer product. Reliance on Human Resources with lack of actionable, verified information has created a vendor-centric purchasing ecosystem which is more biased toward the profiting of vendor/seller instead of optimum catering to customer requirements.

Ideally, trading should involve integrating knowledge, procurement, distribution, and logistics into a cohesive, recorded system. This research component is aimed at streamlining the vendor-based system in trading Fertilizer

Products, by constructing an expert knowledge driven, secure system based on Blockchain technology, relying on accurate identification of nutrient deficiencies.

The transactions across the blockchain is as follows:
a) Identification of best available product
1) Identification of the most adequate remedy
2) Recommendation of available commercial products (Quantity to purchase, Instructions for application)

Furthermore, the blockchain provides secure transactions across a network of nodes for all stakeholders (Farmers, Experts, Vendors) to securely communicate verified information with great transparency. Key functions performed by stakeholders are as follows:
1) Experts (Soil scientists, agro-experts, researchers etc.) who are willing to contribute to the system with expertise and knowledge relevant to Nutrient Deficiencies, Identification and Remedies can contribute (via running a node by downloading transaction history) and these contributions can be broadcasted across the network with efficiency (due to decentralized system used in blockchains)
2) Vendors can update required information on Commercial Products available in a **transparent manner** due to transaction ledger for public addresses being open to viewing, which **increases accountability** and makes vendors responsible to act with integrity.
Blockchain Ledger being usable as an audit trail **improves security and prevents fraud**.
3) Farmers who are running a node can detect adequate remedy and most suitable Commercial Product on identification of nutrition deficiency at relevant stage.

Since any new transaction or changes made in transactions and any change is visible to the consumer (farmer), he can make the most well-informed decision, via a secure and reliable architecture for conveying information and transactions, of which digital records are maintained. Each stakeholder maintains an up-to-date copy, which prevents a single point of failure or data loss, and fraudulent tampering.

DECLARATION

"We declare that the project would involve material prepared by the Group members and that it would not fully or partially incorporate any material prepared by other persons for a fee or free of charge or that it would include material previously submitted by a candidate for a Degree or Diploma in any other University or Institute of Higher Learning and that, to the best of our knowledge and belief, it would not incorporate any material previously published or written by another person in relation to another project except with prior written approval from the supervisor and/or the coordinator of such project and that such unauthorized reproductions will construe offences punishable under the SLIIT Regulations.

We are aware, that if we are found guilty for the above mentioned offences or any project related plagiarism, the SLIIT has right to suspend the project at any time and or to suspend us from the examination and or from the Institution for minimum period of one year".

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