The IOT application in Clean Agriculture (CA) by using N, P, K Sensor to monitor and understand the nutrients in the soil

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Introduction:

Background :

- The development of "Clean Agriculture (CA)" is a principal agricultural policy in Lao PDR. This is because fewer agrochemical inputs are traditionally used in the country compared to surrounding countries.

- However, there exist several issues to overcome for further development of CA in Laos, such as
  - Insufficient technology to support the CA producers to maintain and control the quality of the agriculture products
  - Unable to produce a large amount of crops according to market needs
  - Difficult to control the production costs
  - Potential to produce crops regardless of the season.

Targets:

- The project aims to promote IOT technology in Clean Agriculture (CA) in Laos by enabling IOT technologies to produce the high quality of CA product.

- This research will evaluate the accuracy the devices and study the potential to monitor the amount of main nutrients N, P, K for the tomato farm in the Greenhouse.

Proposed Method:

1. Scientific and technological

- The the structure of the soil nutrition or fertilization is according to the specific crop needs, soil type, water analysis, cultivar, and most importantly- leaning on the grower's experience

- There is many crops are currently introduce to Lao farmer by using the GreenHouse Technology, However this technology is required to deep understand the Characteristic nitrogen (N), Phosphorus (P) and Potassium (K) deficiency symptom
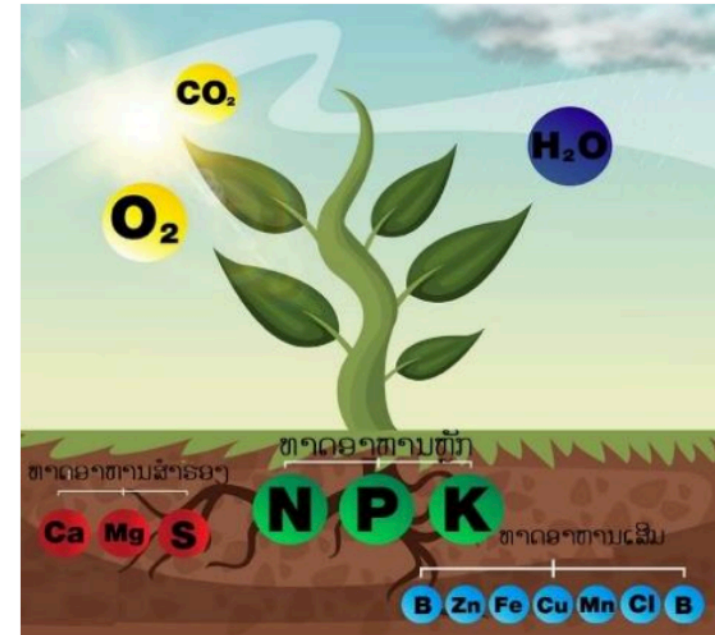

Figure 1. the structure of the soil nutrition

Figure 2. Characteristic nitrogen (N), Phosphorus (P) and Potassium (K) deficiency symptom

2. Implementation

This Project is observing the characteristic and the accuracy of the soil sensor model PR-300-TR-NPK-N01 as shown in the Figure 3. The device is detecting the amount of nitrogen, phosphorous & Potassium in a soil. The advantage of this sensor over a traditional detection method is obtained results very fast and highly accurate.
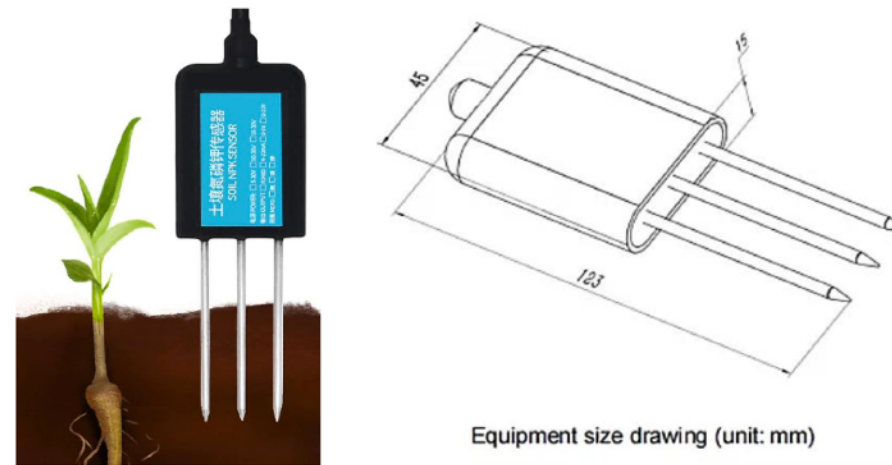

Equipment size drawing (unit: mm)

Figure 3. the structure of the Sensor model PR-300-TR-NPK-N01

Proposed Method:

3. Experiments including field testing

 - The research proposed the experimental study on the Soil N, P, K Sensor to measure the main nutrients of the in soil such as Nitrogen (N), Phosphorus (P), Potassium (K) in Soil by using the Multi Element Sensor

 - There are 18 samples of soils are taken in the Greenhouse and its detail of the experiment field is shown in the figure 4.
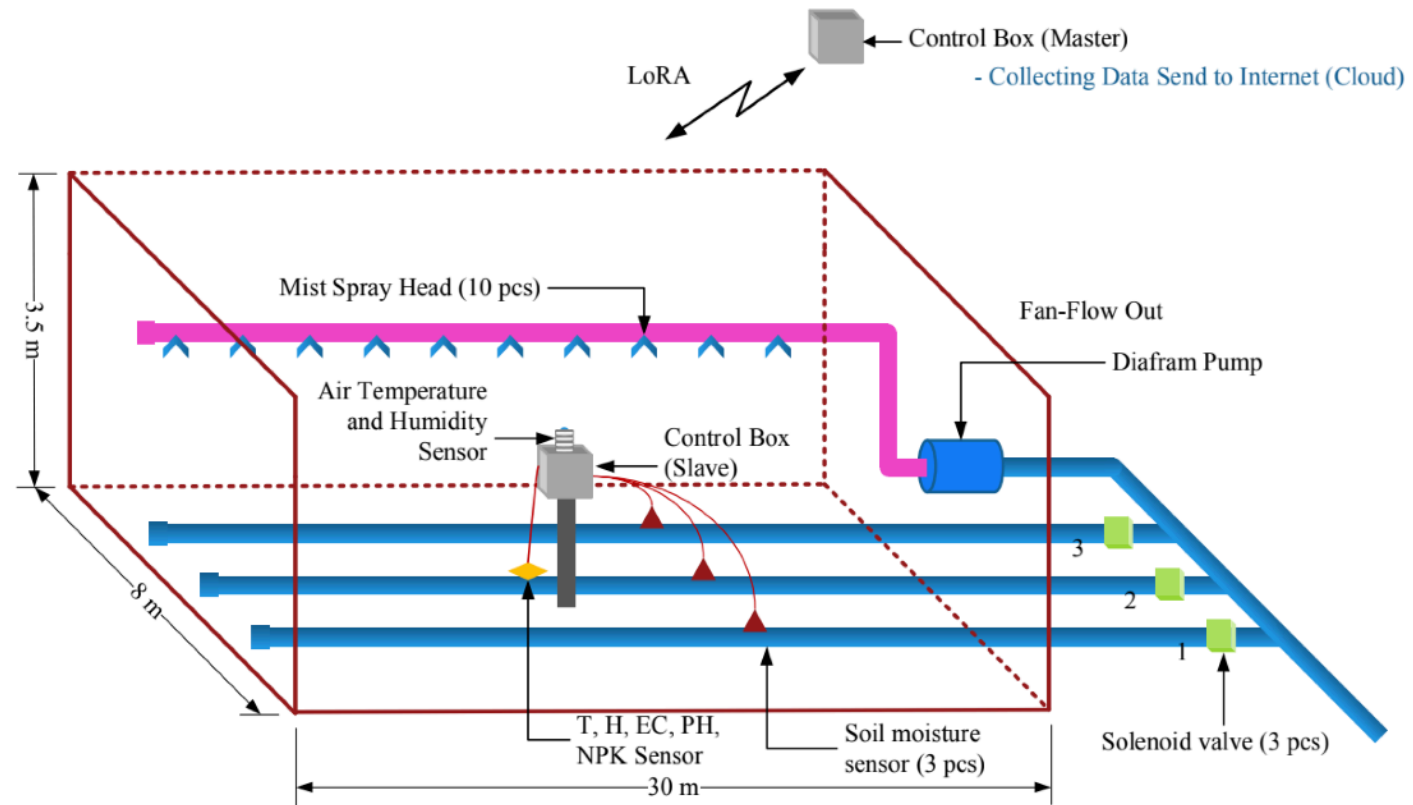

Figure 4. the layout detail of the experiment field

2. Experiments including field testing

   - The selected location is located in vientiane capital, in the Tomato Greenhouse size 8mx30m,
   - The farm's owner is required to understanding the characteristics of soils by observed the N,P, K parameters from the sensor

Figure 5. the Greenhouse of the experiment field

Output/Outcome:

- The outcome of the proposed method is manually collected total 18 samples.

- The results of soil survey for parameter N, P, K and other properties is shown on the table 1

Table 1. the Results of the experiment

ຈຸດອັດແທກ	ປະລິມານສານອາຫານພື້ກ			ຄຸນນະສົມບັດຂອງດິນ			
	N (mg/kg)	P (mg/kg)	K (mg/kg)	H (%)	T (°C)	EC (µS/cm)	PH
1	130	38	52	42.1	32.4	383	3.6
2	95	28	38	29.1	34.4	319	4.2
3	104	31	42	51.7	29.7	236	3.6
4	74	22	29	22.8	31.2	149	4.6
5	56	17	22	47.9	31.46	189	3.8
6	114	34	46	48.4	30.4	173	3.7
7	124	37	50	24.2	30.9	10.3	5.1
8	49	79	108	14.4	34.1	113	5.8
9	212	64	87	42.2	31.1	308	4.3
10	122	36	49	26.2	32.9	260	4.1
11	82	100	137	49	31.7	870	3.4
12	88	26	35	21.4	31.1	490	4.1
13	116	36	47	29.6	30.8	215	4.3
14	125	37	50	22.9	34.5	397	5
15	214	64	87	26.5	33.8	429	4
16	101	30	41	12.2	33.91	110	5.3
17	334	70	95	33.4	31.3	342	3.7

- The results of N, P, K is compare to the conditions of Tomato
- experiment results show that: the properties of the soils has only Nitrogen (N) is good enough for Tomato, the Phosphorus (P) and Potassium (K) is needed to improved the quality of soil to meet with the requirement of the Tomato

ສານອາຫານພືດ	ປະລິມານ (%)	ປະລິມານ (mg/kg)
N	3.00 ຫາ 6.00	30 ຫາ 60
P	0.30 ຫາ 0.80	3 ຫາ 8
K	2.50 ຫາ 5.00	25 ຫາ 50

ແຫຼ່ງຂໍ້ມູນ: A & L, Agronomy Handbook, Ankerman & Large, Eds.
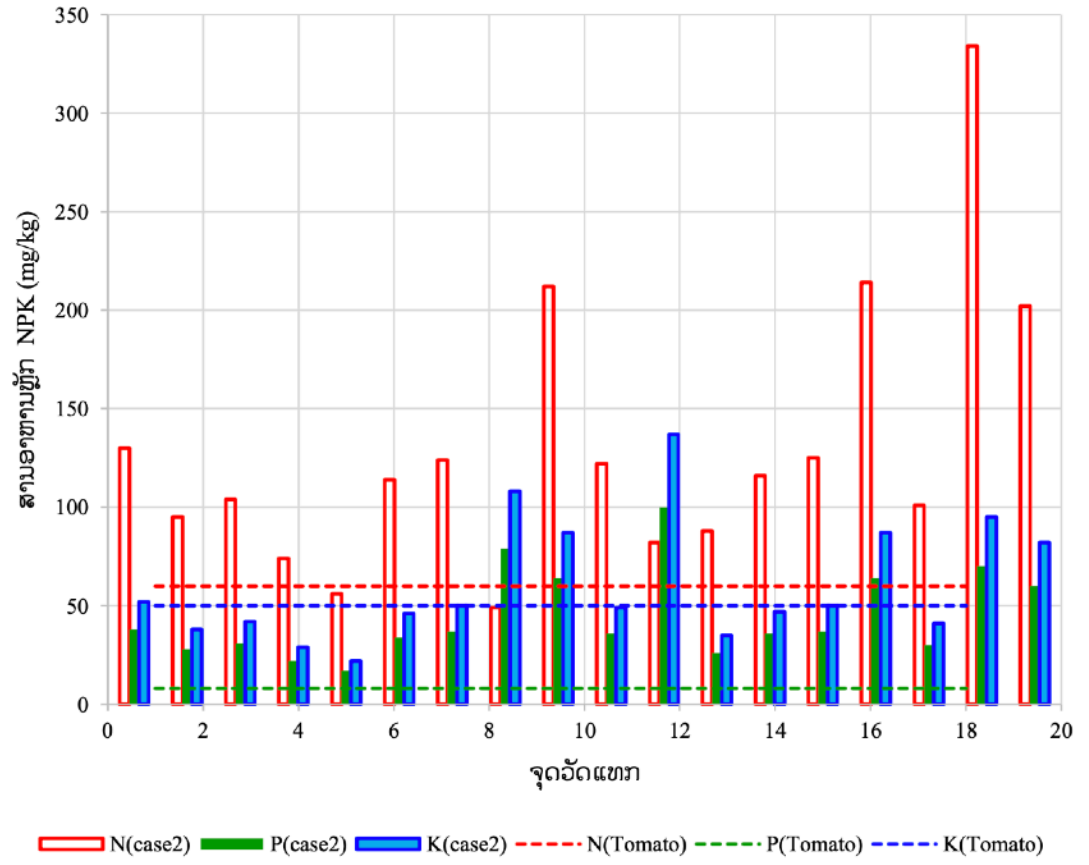
Conclusion:

- This Project is observing the characteristic and the accuracy of the soil sensor model PR-300-TR-NPK-N01
- The device is detecting the amount of nitrogen, phosphorous & Potassium in a soil.
- Future plan is upload the measurement results to store in the cloud, then the data is analysed based on the appropriate criteria for the Tomato plant.
- Moreover, this research will be designed and built a dashboard system to monitor the parameters of various sensors that can be viewed through computers and mobile phones as shown in the
- The research results show that, the Sensors is a high-performance, can read the output value clearly, has a high sensitivity, can be applicable in modern agricultural systems.

Plans for connected projects:
- This project is still in the beginning step, there are many processes to evaluate and confirm the results with the traditional chemical Laboratory and do the real experiment in the real greenhouse.
- The research results not only show the controllable soil fertilizers and the analyzed parameters from the Sensors, this system should be continuing collect data and recommend the conditions for improves the quality of the tomato product in the Greenhouse.