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Analysis Real Life Data for Measuring Probability of Plant Cultivation in Bangladesh

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Abstract: The use of the Internet of Things (IoT) for plant advancement and natural organization is a promising new field of study. An arrangement of reliably interfaced sensors is used here to support data sent for more profitable plant development and an unrivaled circumstance. In this section, we present a system that uses eight different types of sensors to measure the quality of the air and soil. Our structure makes use of dispersed capacity for storing sensor data, which is then organized on the web to produce precise figures on nature and plants using an auto-in reverse facilitated moving typical count. Similarly, the structure has been designed with a web interface and data visualization, allowing people to obtain consistent normal information in order to make better decisions for plant advancement and biological organization. Finally, we want to emphasize the accuracy of prediction data outcomes, which is around 91.00 percent.

Keywords: IOT, Linear Regression, Sensor Node, Prediction, ESP8266.

1. Introduction to IoT based Plant Cultivation System

Because of the close proximity of plants on Earth, it is known as a green planet. Plants are thought to be the most important living creatures on the planet. The earth and human life on this planet cannot exist without plants. I grow plants in our homes, gardens, ranches, and along roadsides, among other places. Their essence is unavoidable in this world for clean air, nourishment, and water. Even these plants contribute to our economy. People in many countries rely on plant products for employment and income. Plants and people are so inextricably linked that we need them to survive. Agronomic plants provide food for nearly every earthbound living being, including humans. I eat either plants or other creatures that eat plants. Plants help to keep the air clean. These plants provide food for nearly 8 billion people on the planet. It is estimated that there will be more than 9 billion people on the planet by the end of 2050 [1] People's Benefits from Plants take the following paths: Plants are the primary source of sustenance for humans. Plants, unlike humans and animals, produce their own food. They do so by utilizing daylight in the process known as photosynthesis in their green leaves. They consume some of the manufactured nourishment and store the remainder. This is saved as natural products such as seeds, tuberous roots, and so on. People consume these soil-derived plant parts. Vegetables, natural products, grains, oats, leaves, seeds, mushrooms, and so on are examples of nourishment. They provide the entire meal, which includes starches, fats, proteins, nutrients, and minerals. At the same time, we may need to rely on animals for a few nutrients. Plants are the primary source of material and texture material. These materials are better for the environment, more durable, and less expensive. As a result, they are used to produce fabric and bedding material that people require. Plants are an important source of furniture. Plant wood is used in the construction of houses as well as the production of other furniture items. We use wood for this purpose because of its qualities such as sturdiness, fashionable finishing, resistance to temperature changes, and so on. Teak, neem, red shoe, and other trees are excellent sources of wood for making doors, seats, racks, tables, and so on. Indeed, the presence of plants in the vicinity of human life reduces stress. As a result, we see a lot of people growing small plants in their homes to get outside air and also to give instinctive nature. We use wood for this purpose because of its qualities such as sturdiness, fashionable finishing, resistance to temperature changes, and so on. Teak, neem, red shoe, and other trees are excellent sources of wood for making doors, seats, racks, tables, and so on. Indeed, the presence of plants in the vicinity of human life reduces stress. As a result, we see a lot of people growing small plants in their homes to get outside air and also to give instinctive nature. Agriculture workers everywhere in the world don't profit, particularly small ranchers, because there is only one side after they pay for all sources of starting investment. Horticulture is dependent on the monsoon, and harvest efficiency varies on a consistent basis. To improve efficiency, continuous efforts should be made in the lead of research on various aspects of yield production, including post-harvest. In light of globalization, the role of research has grown significantly. The research is not a start-and-stop operation. Regardless, it is a continuous procedure for searching for a solution to the issues investigated by agriculturists [3]. In the twenty-first century, one of our most pressing concerns is the development of food-producing plants. As the population grows rapidly, there is an urgent need to develop food-producing plants. To encourage these people, the amount of food available should be increased. Advanced cultivation necessitates increased output without increasing the property estimate. Natural disaster economic losses have reached a staggering average of USD 250-300 billion per year. Reusing similar land is one solution for increasing output; however, the farmland reusing strategy does not always work due to land conditions. We discover a few issues with land reuse in terms of having more generation. According to one study, the earth has lost 33% of its arable land in the last 40 years [4]. The real reasons for this are disintegration and contamination, both of which have a negative impact on farmland. Every year, approximately three million hectares of agrarian terrain are lost due to soil degradation and disintegration. Shrewd cultivation is now being used as a solution.

The use of technology such as the Internet of Things (IoT) in plant nutrition could have a huge impact. It also has an effect on people's personal satisfaction and has long-term significant effects on general natural conditions. The Internet of Things (IoT) is being used to control discharge and reduce the size of air contaminations. Using the Internet of Things in a beneficial way that has long-term positive effects on the environment and the food production sector to create a green nation. As a result, in order to sustain these large numbers of people, the developing business must connect with IoT. Against the challenges of terrible climate conditions and expanding environmental change, as well as the ecological impact of increased cultivating practices, the desire for more food must be met. IoT is a fantastic thing that is distinguished by universally interconnected gadgets or devices and a more unified world. Given the current global state of farmlands, an IoT-based brilliant cultivating device has been developed for the eco-friendly country. A wide range of heterogeneous IoT modules are used to screen a few variables different identified with the states of yield, soil, and condition. Various sensors have been activated to obtain natural information from the cultivating area, as well as soil information, in order to monitor the development and changes of farmland and plants. This device was designed specifically for the observation of soil and plants, and it has been modified to do so. The calculation enables this device to anticipate soil and condition predictions. As a result, precautionary measures can be taken ahead of time to exceed expectations for loaned plant development and to keep a strategic distance from the harms.

2. Review of Previous Works on Plant Cultivation

Some research is being done on the business aspects of cultivating age. These papers use IoT functionalities to more quickly educate farmers about market conditions, for example, the current free market movement of various yields and tamed creatures [5], and to help in the organization of the agrarian business itself, as in [6]. Eventually, [7] and [8] highlight the transportation side of the agribusiness division, despite everything that has been seen thus far, to cut costs and, moreover, by virtue of last, to decrease the spread of foodborne diseases. Masters have similarly based on the general state of IoT usage in various endeavors today close by the future potential this development holds. Makers have also highlighted current barriers to the use of IoT, environmental applications, and developing applications in agrarian territory [9], [10]. Overall, there have been a couple of papers that have uncovered the dispersed state of country data that exists today. An excellent approach is taken by [11], which uses UAVs to create another method to manage various remote framework devices in IoT networks as a sort of helpful sink with the true goal of reducing power use. There are also many research works that have been driven solely on the monitoring of plant lands with the goal of better exhorting farmers with progressing data [12] so that they can take more proactive measures and thus make more capable use of advantages. These structures can screen water treatment to create a greener city [13], temperature, light, sogginess, and moisture level [14]. When all is said and done, achieving capability to the extent of plant advancement and agriculture is an important part of research for any country as a result of the need for sustenance and the creation of all out masses. As a result, much work has been done to improve the viability of cultivating sustenance age [15]. This can be practiced in a variety of courses, one of which is the improved man-agreement of the genuine developing condition. Through IoT, it is possible for homeowners to better examine their property and monitor changes in it, allowing for the maximization of gather and development as seen in [16], and a close application should similarly be possible by methods for the utilization of nurseries, for example, [17]. There are likewise various other research works that are somewhat based on data amassing, something that farmers already do, yet utilizing IoT, conveyed capacity, and remote sensor organizes the methodology of data gathering has been made verifiably more extraordinary with the system being set up to do despite assisting in the essential administration technique of agriculturists, for example, we have seen in [18], [19], which are ordinarily used for profitable reselling. Various works have focused on utilizing the limits of IoT to explicitly automate the country. When in doubt, article [8] employs massive data examination to consider the developing organic framework in order to develop better practices for the future, whereas [20] guides the evaluation of farmland for the sensibility of constructing specific items.

3. System Design and Implementation

3.1 System Architecture and Design

The proposed system model integrated IoT into the overall system via wireless sensor modules. The entire system is self-sufficient. Sensor node is a single node that contains a collection of sensors. Sensor nodes will be deployed at a certain distance for agriculture plant monitoring. So that it can cover as many conditions as possible. These sensor nodes are powered by a solar panel, allowing them to operate throughout the day. These sensor nodes transmit environmental data to the mother server via Wi-Fi. Our prediction analysis will be done from the cloud in order to provide feedback.

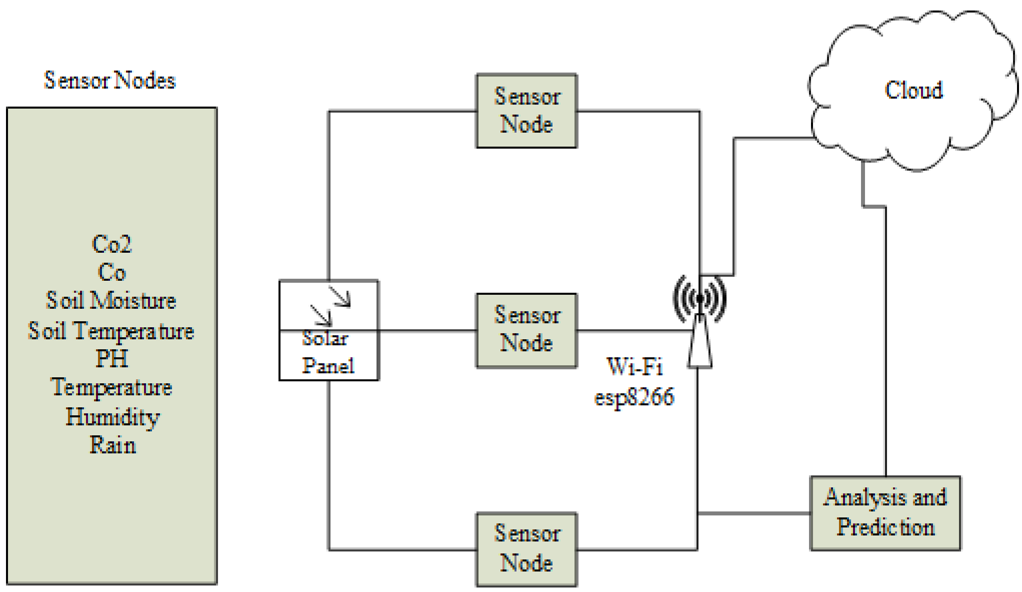

***Figure 1**. System Architecture*

The device is designed to be as space-efficient as possible given the circumstances. A remarkable created circuit has been orchestrated in such a way that it will in general be to a great extent reduced in size. In this circuit, eight sensors were used to estimate the quality of the air and soil, and they were interfaced with an Arduino Uno. DHT11, MQ135, and MQ09 are environmental air sensors. Get the air temperature and humidity from the DHT11 contraption. Gas CO2 regard in ppm from MQ135 sensor contraption. Both MQ9 have been assigned the same estimation system. Furthermore, a Gravity analog pH meter (Model: TOL-00087) has been introduced for soil measurement to determine the soil pH status. The soil temperature is measured using a Digital Temperature Sensor (Model: DS18B20). In addition, for the soil moisture condition, a Grove moisture sensor (Model: SEN-00035) was used. This device outputs real-time values to the Arduino in time intervals. All of the data was collected from sensors in the form of packets. The Wi-Fi module was used to communicate with the devices (e.g., ESP8266). Among the available modules, it is the least expensive. This is the most recent Wi-Fi module available. This communication link is a critical component of my work that introduces IoT. All sensor parameters are transmitted via the internet to the main mother cloud database, which keeps a record of all data received. On the basis of my cloud database, a machine learning-based algorithm has been introduced to perform key function analysis and future predictions. In terms of energy efficiency, my device has been designed to be as efficient as possible. Various renewable energy sources were put to the test in the field. Among the various sources tested, solar power has proven to be the most efficient and dependable system. The energy generating system has been divided into two parts (daytime and night-time) in order to run the device continuously for 24 hours. In the perspective of Bangladesh, solar power has been tested based on the irradiation point in a day. The solar efficiency was then measured in the field, and I concluded that solar power is the best option for the Bangladeshi continent. This device was designed with the welfare of our nation's kin in mind. Keeping that in mind, the overall cost of the framework has been reduced to the point where it is completely reasonable. Furthermore, device setup has been planned so that it can be easily installed by anyone.

3.2 Data Analysis with Scikit-Learn

Regression and classification are the two types of supervised machine learning algorithms. The former predicts continuous-value outputs, whereas the latter predicts discrete-value outputs. Predicting the price of a house in dollars, for example, is a regression problem, whereas determining whether a tumour is malignant or benign is a classification problem. A linear relationship between two or more variables is referred to as "linearity" in algebra. We get a straight line if we draw this relationship in two dimensions (between two variables in this case). In this section, we'll look at how the Python Scikit-Learn machine learning library can be used to implement regression functions. We will perform linear regression with multiple variables. We will predict the percentage of plant cultivation in the Atish Dipankar University of Science and Technology (ADUST) area in this regression task. Because there are only six variables, this is a simple linear regression task.

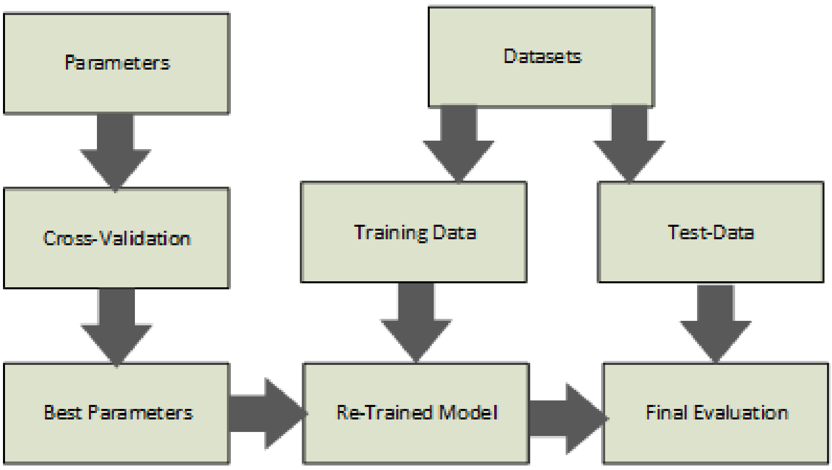

***Figure 2**. Scikit-Learn Flow Diagram*

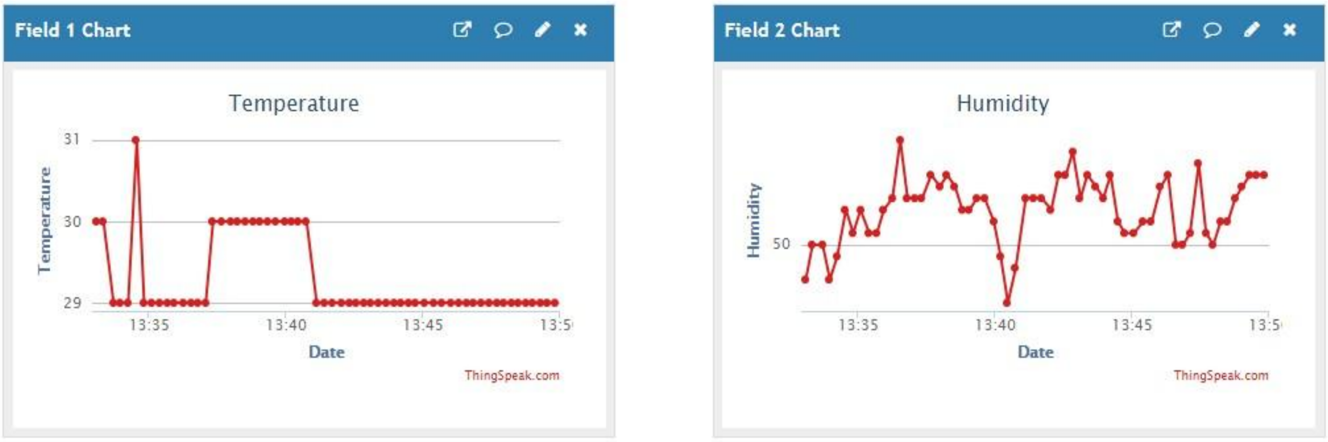

***Figure 3**. Realtime data collection to ThingSpeak of Temperature and Humidity*

The real-time data of the environmental parameter (Temperature and Humidity) are collected in the free server (ThingSpeak) with the help of the internet of Things (IoT). Figure 3 shows the data collection graphical representation of Time Vs Temperature and Time Vs Humidity. These collections of Data are integrated in Xcel file for further process. Another environmental parament such as Carbon di oxide (Co_2), Methane (CH_4) has been measured and data has been collected in the ThingSpeak server showed in Figure 4.

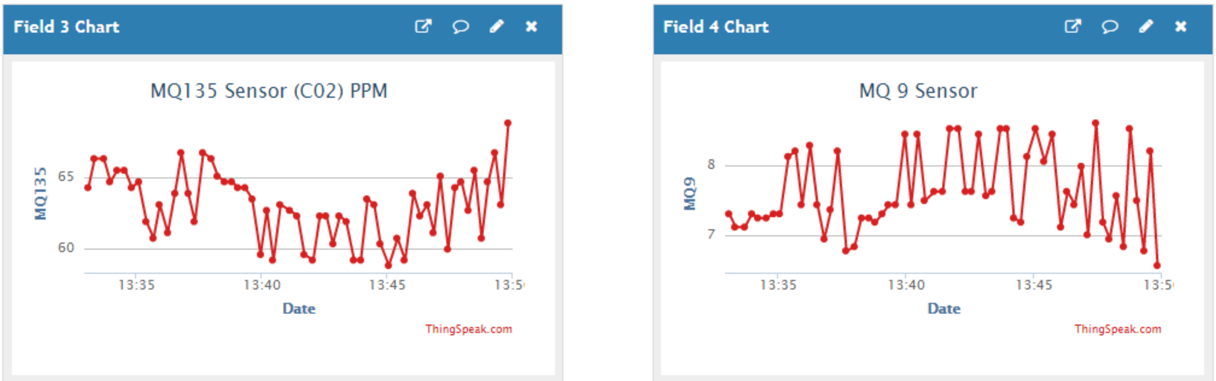

Figure 4. *Realtime data collection to Things peak of* Co_2 *measurement*

Soil is an important element to cultivate crops. For cultivation better crops the soil must have the elements that also present in a soil of better cultivation. So, to cultivate a crop we have to measure the condition of the soil. To measure the moisture and power of Hydrogen (PH) of Soil the circuit arrangement with the help of internet of Things (IoT) are set up to collect the data from the area we want to cultivate the crops. Figure 5 Shows the measure of Soil moisture and PH measurement of Soil and Collection of data in the ThingSpeak. After collection of data from different place we applied the data in the Scikit-Learning algorithm to predict the cultivation of crop.

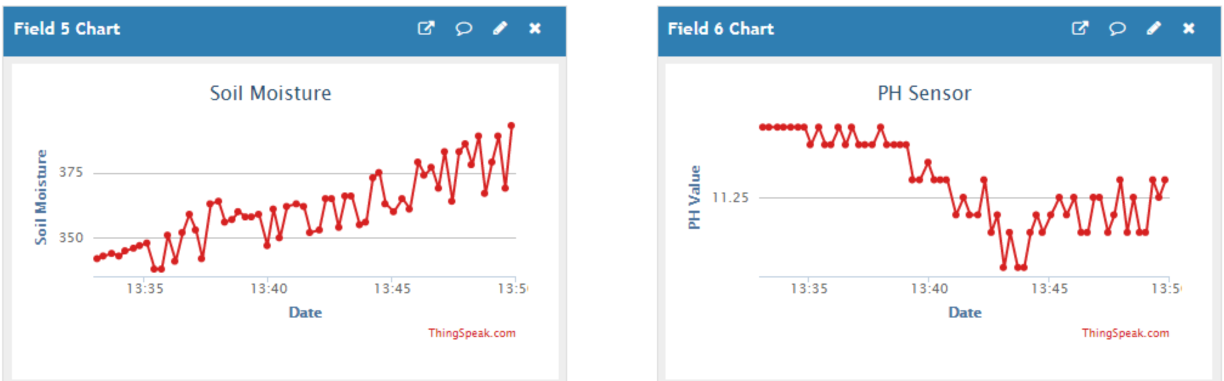

Figure 5. *Realtime data collection to ThingSpeak of Moisture and PH Value of Soil*

Figure 6 shows the real-time data collection circuit setup in some selected areas in Bangladesh. Here we collect data of every element that are related to cultivate a good crop. In this area we collect data from a land where we cultivate some crops.

Figure 6. *Realtime data collection Circuit Setup in some selected areas-1 in Bangladesh*

Figure 7 and Figure 8 show the real-time data collection circuit setup in some selected areas in Bangladesh respectively. From here we have also collected data of every element of cultivating a good crop.

Figure 7*. Realtime data collection Circuit Setup in some selected areas-2 in Bangladesh*

Figure 8*. Realtime data collection Circuit Setup in some selected areas-3 in Bangladesh*

4. Result and Discussion

The System is proposed and tested. we have used the Scikit-Learn python library to analysis the real life collected data. we have trained and tested the random data from the collected data using the Scikit learn along with Multiple Linear Regression. Here we got the Mean Absolute Error: 0.0836, Mean Squared Error: 0.0101, Root Mean Squared Error: 0.10098. The Model accuracy is 91%. The tested and predicted data after training is showed in below Table 1.

Table 1 : Data Prediction after Training and Testing

Actual	Predicted
0	0.092797
0	0.025766
0	0.098237
0	0.078609
0	-0.006061
0	0.114811
0	0.135015
1	0.905028
1	0.826964

From the above Table 1 we showed that the actual measuring result of cultivation of good crops we have selected as the true value of 1 and the measuring result of cultivation of bad crops we have selected as the false value of 0. After the prediction of data analysing, we found that the predicted value is almost same as the selected result.
After training we have tested some data and predict the result which was nearly accurate. The result table is given below.

Table 2: Data Prediction by giving some test input

SL No	Temp	Hum	MQ135(Co_2)	MQ9	Soil moisture	PH	Result	Remarks
1.	44	59	220	9	995	11	0.997	Plant Cultivation Possible
2.	40	50	210	20	995	10	-0.122	Plant Cultivation Not Possible
3.	35	60	250	1	800	12	1.869	Plant Cultivation Possible

From the table 2 showed that the model is working accurately. The accuracy of the model is more than 91%.

5. Conclusion

Every day, the world is surrounded by new innovation and technology. IoT is one of those things that takes all of these innovations to the next level. IoT is a promising new advancement that enables device interoperability and machine-to-machine communication to astounding levels. These characteristics compel me to greatly expand the accommodation of any electric contraption used in normal everyday presence or in had some skill in distress by retrofitting IoT abilities to them. Plants play an important role in human development and a sustainable global environment, and this requires a long-term relationship between the environment and the plant. In the field of agriculture and plant biology, one of the most pressing issues today is how to keep agriculture sustainable in the face of global climate change. Monitoring the soil and air environment is especially important for plant cultivation systems. When it comes to plant development, the use of IoT can be enormously beneficial. With an annual growth rate of about 2%, the global population is approaching three billion, and it is growing faster than at any other time in history. As a result, population is a huge issue, and with population comes the need for crop productivity. Monitoring the plant and environment before it becomes unstable is also very important in this state of unstable population, global warming, and other environmental problems that are getting worse by the year. A close and consistent monitoring of air, soil, and plant cultivation is critical for achieving maximum productivity from the agricultural system.

Reference

[1] F. R. Bach and M. I. Jordan, "Learning graphical models for stationary time series," in IEEE Transactions on Signal Processing, vol. 52, no. 8, pp. 2189-2199, Aug. 2004.doi: 10.1109/TSP.2004.831032

[2] Bartholomew, and D. J. Oper, “Time series analysis forecasting and control”, Journal of the Operational Research Society, vol. 22, no. 2, pp. 199-201, June. 1971.

[3] R. Elsheikh, A. Rashid B. Mohamed Shariff, F. Amiri, N. B. Ahmad, S. Kumar Balasundram, and M. Amin Mohd Soom, “Agriculture land suitability evaluator (ALSE): A decision and planning support tool for tropical and subtropical crops”, Computers and Electronics in Agriculture, vol. 93, pp. 98-110, April. 2013.

[4] P. M. Gotovtsev, and A. V. Dyakov, “Biotechnology and internet of things for green smart city application”, Proceedings of the IEEE 3rd World Forum on Internet of Things, pp. 542-545, 2016.

[5] G. Writer, "IoT Applications in Agriculture”, iot for all, 2018. [Online]. Available: https://www.iotforall.com/iotapplications-in-agriculture. [Accessed: 18- Nov- 2018].

[6] R. J. Hyndman, and Y. Khandakar, “Automatic time series forecasting: the forecast package for R”, journal of statistical software, vol. 27, no. 3, pp. 1–22, July. 2008.

[7] C. Ji1, H. Lu, C. Ji, and J. Yan, “An IoT and Mobile Cloud based Architecture for Smart Planting”, 3rd International Conference on Machinery, Materials and Information Technology Applications,Atlantis Press, 2015.

[8] A. Kamilaris, A. Kartakoullis, and F. X. Prenafeta-Boldú, “A review on the practice of big data analysis in agriculture”, Computers and Electronics in Agriculture, vol. 143, pp. 23–37, 2017.

[9] H. Kang, J. Lee, B. Hyochan, and S. Kang, “A design of IoT based agricultural zone management system”, Information Technology Convergence, Secure and Trust Computing, and Data Management, vol. 180, pp. 9-14, 2012.

[10] F. Karim, F. Karim, A. frihida, “Monitoring system using web of things in precision agriculture”, The 12th International Conference on Future Networks and Communications, vol. 110, pp. 402-409, July 2017.

[11] K. v, and Dr. G. N. Kodandaramaiah, “Cloud IoT Based Greenhouse Monitoring System”, Keerthi. v Int. Journal of Engineering Research and Applications, vol. 5, no. 10, pp. 35-41, Oct. 2015.

[12] S. Mehrmolaei, M. Reza. Keyvanpour, “Time series forecasting using improved ARIMA”, Artificial intelligence and robotics (iranopen), pp. 92-97, 2016.

[13] M. Lee, J. Hwang, and H. Yoe, “Agricultural production systems based on IoT”, IEEE 16th International Conference on Computational Science and Engineering, pp. 833-836, 2013.

[14] O. Milman, "Earth has lost a third of arable land in past 40 years, scientists say”, the gurdian.com, 2015.[Online]. Available: https://www.theguardian.com/environment/2015/dec/02/arable-land-soil-food-securityshortage. [Accessed: 19- Nov- 2018].

[15] I. Mohanraj, K. Ashokumar, and J. Naren, “ Field Monitoring and Automation using IOT in Agriculture Domain”, 6th International Conference on Advances in Computing & Communications, Cochin,India, vol. 93, pp. 931-939, 2016.

[16] M. Nadim, M. Rashedul. Haq. Rashed, A. Muhury, and S. Mohammad. Mominuzzaman, “Estimation of optimum tilt angle for PV cell: a study in perspective of Bangladesh”, 9th International Conference on Electrical and Computer Engineering, Dec. 2016.

[17] R. Nau, "Statistical forecasting: notes on regression and time series analysis”, 2018. [Online]. Available: https://people.duke.edu/~rnau/411home.htm. [Accessed: 19- Nov- 2018].

[18] R. Nukala, K. Panduru, A. Shields, D. Riordan, P. Doody and J. Walsh, "Internet of Things: A review from ‘Farm to Fork’", 2016 27th Irish Signals and Systems Conference (ISSC), Londonderry, pp. 1-6, 2016. doi: 10.1109/ISSC.2016.7528456

[19] T. Ojha, S. Misra, and N. Singh. Raghuwanshi, “Wireless sensor networks for agriculture: The state-ofthe-art in practice and future challenges”, Computers and Electronics in Agriculture, vol. 118, pp. 66-84, Oct. 2015.

[20] D. S. Paraforos, V. Vassiliadis, D. Kortenbruck, K. Stamkopoulos, V. Ziogas, A. A. Sapounas, and H. W. Griepentrog, “A Farm Management Information System Using Future Internet Technologies”, 5th IFAC Conference on Sensing, Control and Automation Technologies for Agriculture, vol. 49, no. 16, pp. 324-329, Aug. 2016.