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Automation in Agriculture for Efficient Farming

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Abstract: ***Agriculture is the basic source of food supply. The automated irrigation and crop monitoring system used to optimize the use of water resources. Real time monitoring data can be utilized and the performance can be tracked. Hence high yield can be achieved. Numerous seasonal, economic and biological patterns influence the crop production but unpredictable changes in these patterns leads to a great loss to farmers. These risks can be reduced when suitable approaches are employed on data related to soil type. Agronomy based sensor device is introduced in the crop production for the betterment of crops. Those sensors will enable the mechanism of finding nutrients, maintaining moisture level in soil as well as water level in the tank and eradicating pest. A combined design of different sensors is coordinated with an integrated circuit. These agricultural data's aid farmers to decide on the crop they would like to plant for the forthcoming year leading to maximum profit.***

Keywords: Automation, IoT, Precision, farming

1. Introduction

When the ball of fire gets cool and concerned, the earth has formed. The man started his civilization life before 18,000 years ago. Accidentally he has turned into a domestic life by the invention of fire. It leads to cooking and had his different types of food. He started to identify the edible crops from the wild varieties. Thus, the cultivation of crop is originated.

The origin of cultivation starts with kingdom eras. Later, he started using tools to prepare the land and he termed the animals in cultivation. This leads the man to start his agriculture technique in crop development. Initially it was done with the help of plough and basic tools. As the population increased, man started thinking of advanced technologies to improve agriculture. Some scientist like Dr. M. S. Swaminathan brought green revolution in our country. There are different types of revolution such as blue revolution, white revolution and sliver revolution. These are eminent turning point in Indian agriculture system by the continuous increase in population. It becomes population explosion and increasing of industrialization, urbanization and colonization leads to shortage and shrinking of cultivable lands. So that population, flood, famine and starvation are widely spread which are not avoidable.

To control and bring back the normal saturated conditions by supplying adequate amount of food to each and every citizen in our country. We have to adopt modern digital methods in agronomy. Introducing this type of intervention of IoT and digital sensors in agriculture practices will enhance the yield of pure line breads. This will also promote pure line selection of individual species [14]. Through this method endanger and extinction species can be developed.

As the different branches in biology like biotechnology, microbiology and nanotechnology, there will not be a significant development observed in cop cultivation. It can be rectified by the introduction of IoT along with the modern concepts of agriculture techniques [13]. There are some short falls even in this type of technology. Specific types of crops alone can develop by this method. This will not saturate existing population level. We are in a position to face the challenges against starvation, famine, natural calamities. It is the need of the hour in development of sustainable crops which will feed the expected level against the increasing population. Hence, we adopt the digital technology collaborated with GSM and internet system to create the awareness of crop development to each and every common man

2. Literature Review

Kumar et al (2019) proposed to increase high yielding varieties and to improve same type of crops cultivated in a specific soil. The selection may be clone, mask or pure line. One of the best methods is pure line selection. This method helps to develop a particular type of plant by the certain parameter are observed. They are soil colour (red soil, clay soil, alluvial soil, loamy and black soil), pH of the soil (acidic or base) and temperature. A particular plant requires a specific type of soil, pH and temperature. So, these parameters can promote the growth of high yielding crops by selecting a suitable crop.

Vijayalakshmi et al (2019) have mentioned that during the growth of the plant there may be a chance for cause of pest based on the plants. This can be detected manually or using database method. Physical detection of pest affection is a tedious job and it consumes lots of energy and time. This will lead to loss of grains if the physical observation is not done in a proper time. To avoid this, if a pheasant adopts a database come a sensor to detect the pest affected plant will reduce a loss of grains. Whenever any conflict in temperature and humidity values required by the plant exceeds, the plant undergoes the effect of pest. Due to the act of pest chlorosis and sometimes necrosis may occur in the plants. Some of the plants indicate the deficiency of chlorophyll content by decolourization against its normal condition. This decolourization or the chlorosis appearance is detected by the sensor and it compared automatically with the normal healthy plant database with the help of Raspberry Pi. The abnormality or the difference between the affected and healthy plant data will be compared with the Raspberry Pi and the difference indicated periodically to the crop developer by GSM module.

El-magrous et al (2019) proposed that farmers can grow healthy and high yielding plant with the help of global con-

cern. Global concern acts as a guide liner to the farmer. A well-established database weather station is centrally situated and it has articulated of local substations (weather data station). The local station and the central station are always linked together and it reciprocally exchanges its data through cloud and gives benefit to the farmers. The central weather station which has a standard data about the moisture, temperature and availability of water (irrigation types) are enlisted within it. The local weather stations also have specific areas (endemic) of data about that particular area.

Fiona & Anitha (2019) proposed that in crop cultivation selection of crop is an important factor. It can be done either manually or automatically. In manual process there is a chance of misconception of the characters of the plants and there will be defect in selection. Here comparison of plants is not considered and the criteria are physically tested. In this process we can get pure line breeding and internal characters are not analysed. Comparative accounts of internal characters are neglected. This will produce breeding and cannot expect the required yield. In automated detection of crop, the original plant characters along with external and internal features are fed in the device. This will manipulate the selection of crop according to the environment by having the criteria are already fed in the device. The selection of plants is done with a comparative parameter with the healthy and normal plants image in the automated plant detection device. Because of this the complete internal and external character are analysed with image processing technique. Hence pure line breeding and healthy plant development for higher yield is obtained.

Richard Charles Andrew & Reza Malekian (2018) proposed that as technology developed in various fields and it is implemented in the betterment of different class people. IoT is taken up in consideration with precision farming. In agronomy advanced technologies are implemented to develop the production of crops. Though the advanced agronomy is followed there is a defect and loss of production in crops. To saturate this deficiency technology sensor are used to rectify the shortcomings in the system. Sensors are used in different sectors such as irrigation and controlling of temperature will enhance the growth of the plant, supply adequate level of temperature and feed water whenever required by the crop. If moisture content in the soil undergoes changes that can be rectified by a specific sensor under IoT system and it is immediately solved by entering the moisture content. The irrigation process, soil moisture and temperature for the plant are well maintained. This promotes the growth of a plant so that farmers will get benefited and their physical presence is also avoided with the help of IoT.

Pawar & Chillarge (2018) have mentioned that farmer have to adopt algorithm data for the betterment of crop production. A standard data is recorded on every individual local area. The data dealt about the toxicity and pH of the soil. A comparison account is taken on the crop which is to be cultivated in a particular area to find out the toxicity and pH of that confined soil. The above data will alert the farmer about the condition of the soil and indicates the specificity of crop to be in that field. By this method the soil fertility is detected by experimenting the pH value and the toxicity of the soil. It creates the awareness to the farmers on deficiency or surplus amount of toxic nutrients present in the field. Hence the farmer gets benefit either to remove the toxicity from the soil or to improve the pH value of the soil. This will enhance the growth of the plant and yield.

Rosero-Montalvo &Jose Pijal-Rojas (2018) proposed that irrigation and humidity play an important role in the development of crops and it is persistent to the next generation. These two factors are monitored by a wireless sensor which maintains the humidity level in the atmosphere around the crops. In general, the humidity in the atmosphere is directly proportional to the level of transpiration by the temperature intention on the plant. High temperature leads to high transpiration rate so that the humidity range will decrease. This is avoided by the role of humidity sensor and it restricts the temperature level around the plant. Due to this transpiration rate is reduced and the evaporation level is also controlled. So, the moisture content and humidity level in the atmosphere is maintained. With this process the humidity level in the atmosphere is highly resistant to continue the development of next type of crop. So that the varied humidity level maintained in the atmosphere is controlled by the sensor. Hence the humidity is controlled for a longer duration at different level allows the field to develop crop rotation.

Arooj et al (2018) proposed that the basic and foremost requirement for the crop development is soil. The selection of fertile soil in different area is recorded with the help of mining database. Data mining of soil is done by taking the soil samples of different types and it is tested against its fertility condition, pH value, toxicity, availability of nutrients, presence of microbes and geographical structure. All these data are recorded and preserved in the database center which serves as a service center to the farmers. These database guides the farmer to select the particular crop for a particular type of soil in their local areas. So that the farmers can avail the selection of crop and soil in it's surrounding. The farmers get awareness on their field and the soil types. This will promote to develop the crops with higher yield.

Gupta et al (2018) proposed that by using the sensor seed sowing process are monitored. In general, the seeds are sowed by hand spreading or drilling method. Spreading will lead to congestion of areas in the field. It will not allow plants to grow healthily because of congestion. This can be avoided by drone technology which is used to measure the area requirement for the growth of individual seed. Due to this nutrient supply will be issued to every individual. For the growth of the plant irrigation is required in periodic intervals. Farmer generally prepares the land before they sow the seed by watering. Sometimes soaking of water occurs in the field. This will spoil the growth of the field. This is also leading to lack of water for the growth of the seed. Both the above-mentioned characteristic features can be rectified by using the sensor. The sensor will act as an irrigator and it allows the optimum level of water required by the seed during its growing period.

3. Methodology

Introducing of IoT technology reduces the manual work. Visual graphics and data are obtained periodically.

- No wastage of water and nutrients is a significant feature of this device.
- The consumption of nutrients and the water is always monitored and maintained.
- Crop is always under the optimum temperature level so that higher yield is obtained.
- Fertility of the soil is regularized systematically with the help of sensors.
- Automatic pest control avoids manual labor and economy.
- It reduces air pollution and health hazard problems by reducing the use of pesticide.
- Pure line varieties of crops can be cultivated by this method.

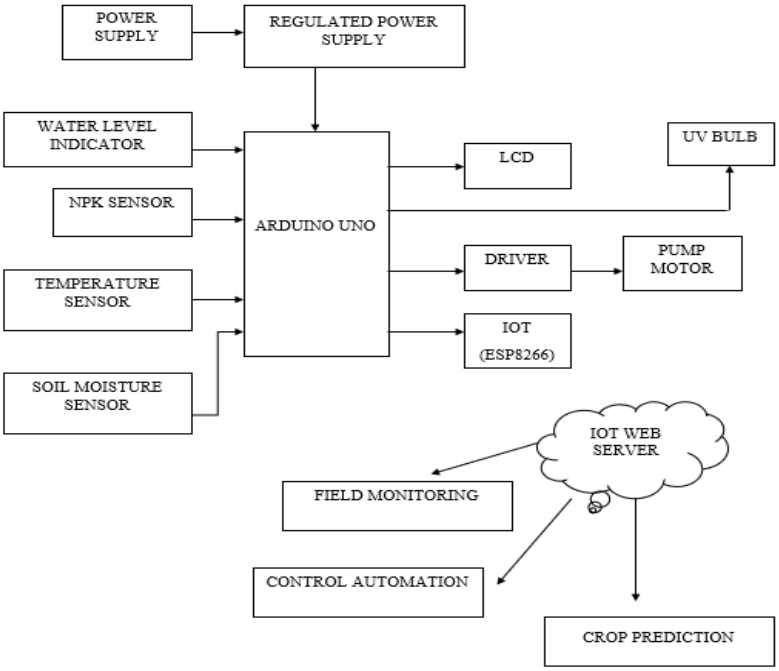

Figure 1: Block Diagram of Proposed System

4. Results and Discussion

4.1 Software Results

The software result is obtained through IoT in web server created in Thing Speak. The farmer has his own login id and password. The data will periodically and permanently in this web server.

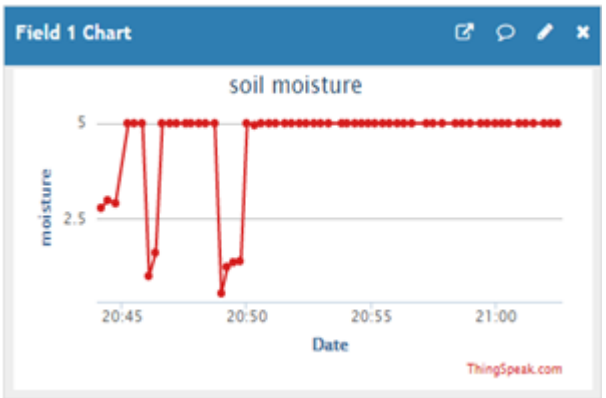

Figure 2: Monitoring moisture sensor data using IoT

So that by viewing the web server all data about the field and soil can be obtained. Here field chart for each parameter is created distinctly. The result of each parameter is as follows.

A clinical graph is derived based on the soil moisture sensor function. The amount of soil moisture utilized by the crop from the soil is periodically observed and monitored. The monitored measurement is drawn in a graph automatically by the value obtained from soil moisture sensor. This will give the accuracy of soil moisture utilized by the crop at all periods is shown in Figure4.14.

Temperature sensor shows a graphical display at regular intervals based on the variation in the atmosphere around the field. With this the optimum level of temperature and the deficient level of temperature can be understood with the help of this graph in Figure 4.15. This temperature clinical graph can be further used for analysis purpose.

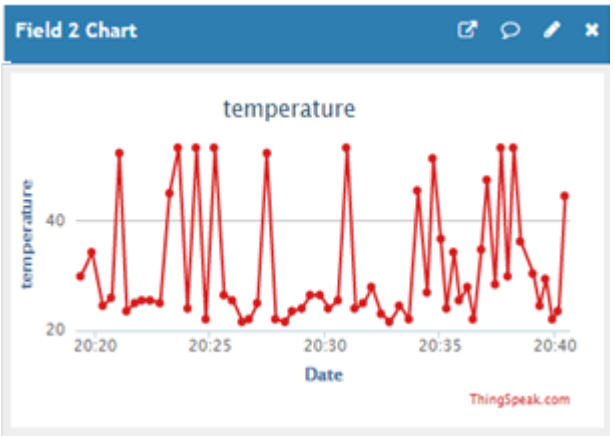

Figure 3: Monitoring temperature sensor data using IoT

Irrigation process is monitored by the regulation of the sensor. Streamlined supply of water is allowed to the crop and it also protects the crop from inadequate level of water content for the plant. It maintains the water level in the source which is shown in Figure 4.16.

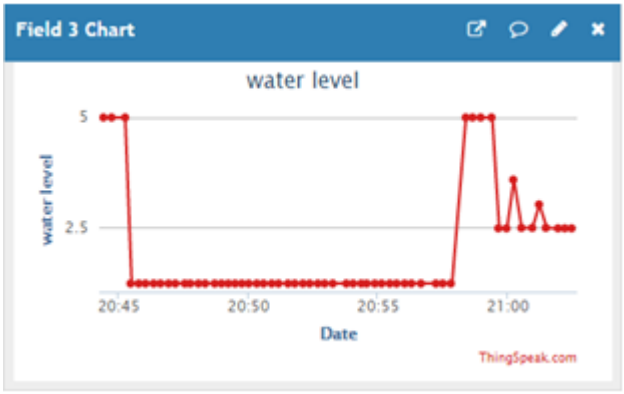

Figure 4: Monitoring water level indicator data using IoT

The supply of basic nutrients (NPK) is monitored and maintained by NPK sensor. The amount of consumption of individual nutrients such as nitrogen, phosphorous and potassium is shown separately in the graph.

The graph indicates the amount of nitrogen availability in the soil can be obtained at any time with the help of the graph. The same process is followed for other nutrients phosphorous and potassium. All the three graph displays the obtained level of nutrients in the soil in Figure 4.17, 4.18 and 4.19respectively

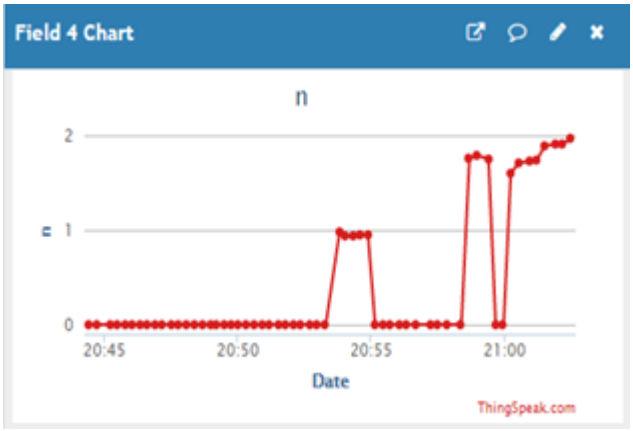

Figure 5: Monitoring nitrogen (N) data using IoT

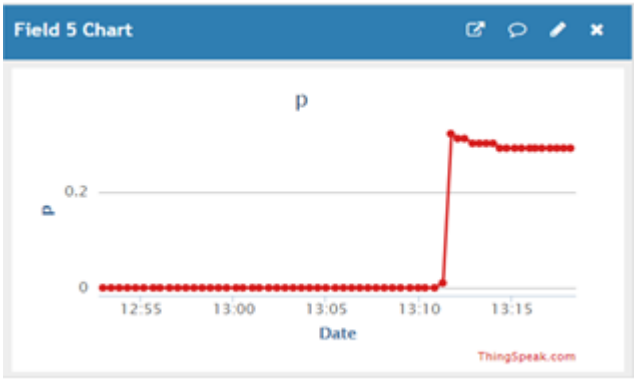

Figure 6: Monitoring phosphorous (P) data using IoT

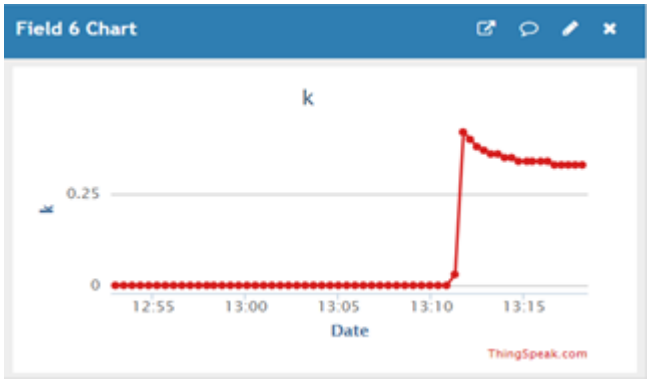

Figure 7: Monitoring potassium (K) data using IoT

In all the three field charts, the value of nitrogen, phosphorous and potassium values are obtained according to the field survey during the project demo. This will enhance the growth of the crops in the field with enough and sufficient amount of nutrients. So that the farmer can yield high with enough nutrient content in the soil.

B SMS ALERT SYSTEM

In this device, if any deficiency of any soil parameters such as Nitrogen, Phosphorous and Potassium as well the soil moisture level, water level in the storage tank occurs should be known to the farmers immediately. The GSM module helps in intimation of alert message to farmers as shown in the Figure 4.20.

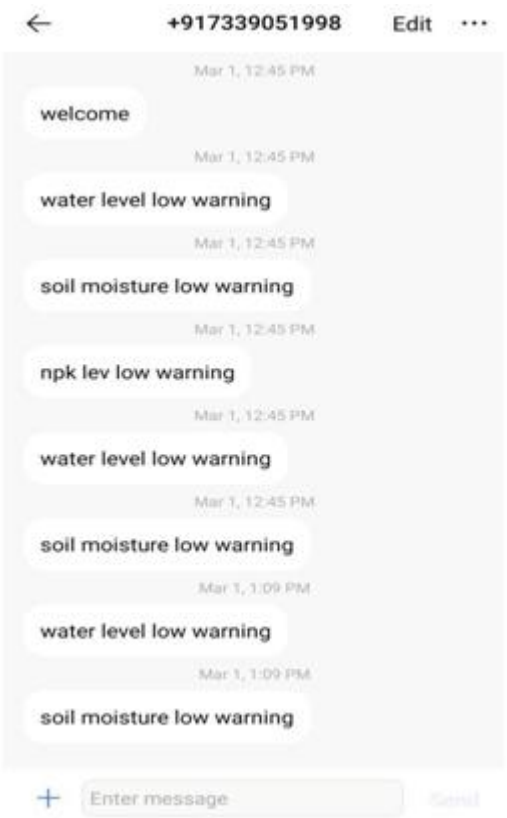

Figure 8: SMS alert

5. Conclusion

The current generation farmers are facing several problems in agriculture and they do not get proper guide to proceed. They had been looking forward to technologies to improve

their farming quality and quantity. The IoT and data analysis will be very useful to them and influence their agriculture in the positive way to get precise knowledge in soil parameters. Pure line breeding can be done with this method. Wastage of grains is much reduced. The set of integrated sensor technologies help them to get the information about their field in their hands at any time. This would play a vital role in water management, selecting the appropriate crop for cultivation and also to reduce the use of chemical fertilizer and pesticides. It also promotes the economic level of the farmers. The growth of healthy crop can be developed.

If any deficiency of nutrient occurs, the optimal level should be supplied automatically. Renewable energy like solar can be integrated and used as power source. Soft marketing can be designed so that the farmers can able to sell vegetables in profitable manner. Controlling temperature and humidity as like green house farming can be implemented in outdoor farming too. Image processing technology can be implemented to check the crop ripened state. Short term decomposition technique can be formed to decompose insects caught by pest eradication technique to feed as organic manure to field.

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