SMART AGRICULTURE MONITORING SYSTEM USING IOT

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ABSTRACT

Agriculture is turning into a vital growing sector throughout the globe because of increasing population. Major challenge in agriculture sector is to boost farm productivity and quality of farming while not continuous manual observance to meet the apace growing demand for food. Except for increasing population, the temperature change is additionally a giant concern in agricultural sector. The aim of this analysis work is to propose a sensible farming methodology supported net of Things (IoT) to upset the adverse things. The sensible farming will be adopted which supply high preciseness crop management, assortment of helpful knowledge and automatic farming technique. This work presents Associate in nursing intelligent agriculture field observance system that monitors soil wetness and temperature. When process the detected knowledge it takes necessary action supported these values while not human intervention. Here temperature and wet of the soil are measured and these detected values are keep in ThingSpeak [11] cloud for future district attorney metallic element analysis.

Keywords: **Internet of Things, sensible Farming, Agriculture, ThingSpeak cloud.**

1. INTRODUCTION

In line with Beecham's report entitled "Towards sensible Farming: Agriculture hold the IoT Vision" predicts that food production should got to increase by 70% within the year 2050 so as to fulfill our calculable world population of nine.6 billion individuals [9 cerium, it is very important to boost up the agricultural productivity to make sure high yield and farm gain. The major challenge in quality farming is unpredictable weather and environmental conditions comparable to precipitation, temperature, soil wet etc. Moreover, wetness is one in every of the foremost environmental parameter in farming because it affects the state pressure of plants, that is Associate in Nursing indicator of the quantity of water in plant cells. Once the quantity of wetness in air is low, transpiration takes place terribly quickly in plants. Further, because of high rate of transpiration, plants wilt apace as an excessive amount of water is force out from plant cells. On the contrary, once quantity of wet in air yet as temperature is high, the speed of transpiration is reduced that successively restricts phase transition cooling. so as to watch these environmental conditions and action are taken consequently, continuous manual effort was needed that is quite impractical and unattainable all the days.

During this respect, IoT plays a major role in implementing the construct of sensible farming to change the farming operations. IoT is new computing and communication paradigm during which the objects of existence have equipped with sensing element, microcontroller and transceiver to sense the encompassing environmental parameters. additionally, communication of the detected knowledge with each other or user, turning into Associate in Nursing integral a part of net system. In IoT, each objects utilized in our daily life with distinctive symbol is connected with one another in order that they will send knowledge over the network while not human intervention [1, 2] . IoT is growing day by day as many more objects are attending to be connected throughout the globe. IoT will be utilized in many various domains comparable to preciseness agriculture [1, 2] , Smart grid [3] , environmental monitoring[4] etc. IOT technology no dazed is gaining popularity in agricultural field for its extremely scalable, practical and pervasive nature.

To change the farming operations, many environmental parameters those have impact on farming, are needed to trace down at totally different locations. The vital environmental parameters embrace temperature, moisture, and water level. Differing types of sensors are deployed over the sector to monitor those environmental parameters relating to farming and connected with microcontroller. In line with environmental condition, microcontroller controls totally different actuators or farming instrumentality (Pump, Fan etc.) while not human intervention. Except for that these detected knowledge will be keep within the cloud. Microcontroller connected with Wi-Fi module sends those detected parameters to the cloud. Most wireless surroundings observance system uses GSM based mostly and or CDMA/GPRS technology. however they need many disadvantages together with high value of network forming, low access rate etc. To be the part of net, the objects have distinctive symbol. Internet Protocol version 6 (IPv6), Internet Protocol version 4 (IPv4) is usually used as a singular symbol of the objects.

The remainder of the paper is organized as follows. Section II highlights connected work on sensible farming. Section III describes the planned system style for IoT based mostly sensible farming. Section IV presents the experimental setup for implementing the planned system and results. Finally, Section V concludes the paper.

1. RELATED WORK

In [5], M . Abdurrahman, et.al. proposed a cost - efficient product for farming wherever water is scare. The system created up with cheap sensors and straightforward electronic equipment to mechanically control the flow of water. The wetness and temperature level are detected and displays in LCD. This method provides water for plants in line with the soil wet level and crop water demand.

P. A. Bhosale and V.V. Dixit have planned in [6] Associate in Nursing endemic low value time depended microcontroller based mostly irrigation hardware that consists with numerous sensors for detective work wet, temperature and wind. this method derives applicable actuators (relay, magnet valves, motor) counting on these values. The captured knowledge is sent to the user in kind of SMS through GSM module and keeps into a memory card.

In [7], J. Balen don ck , et. al. conferred a deficit irrigation management system consists of a network of in-field irrigation controllers and soil sensors. Irrigation controllers are connected to farmer's pc through wireless link. The system will be used once there's a restricted facility, poor water quality or once activity is prohibited. They used call network (DSS) that helps farmers to optimize irrigation and plant food management on the idea of chosen crop, water handiness and crop development. The DSS could run either in native pc or remote server and user will refer to DSS if required for dynamic the irrigation ways.

In [8], F. TongKe proposed smart agriculture based on IoT and cloud computing. Agriculture data cloud is created with totally different resources to realize dynamic distribution of resource and cargo reconciliation. Great amount of knowledge obtained through RFID, wireless communication are handled in agriculture data cloud.

Ji-Chun Zhao et al. studied the management network and IoT technology for agricultural production. The author planned remote observance system supported net and wireless communication. Associate in nursing data management system is additionally designed to store the information. The collected knowledge will be used for agricultural analysis facilities [10].

Not like the work conferred in [5, 6], our proposed model in this paper not solely give value effective sensible farming that change the farming operations however additionally it recorded the agricultural field temperature and wet values to the cloud surroundings through communication technology for more analysis. Further, in [8] the implementation was missing, but this paper includes the implementation details of our planned model. Table one show's a comparative study of our planned system with alternative connected works that are mentioned here.

2. PROPOSED SYSTEM

Our main objective of this work is to style Associate in Nursing IoT based mostly sensible farming to manage high voltage electrical devices like pump, flap of playhouses etc. while not human intervention counting on environmental parameters like soil wet and temperature. These parameters are kept in cloud for future knowledge analysis. Farming is completed inside playhouses for higher controlled surroundings. The planned system is consisting of various layer as delineated in Fig. 1. it's divided into four modules: sensing element layer, Middleware, Communication Layer and Cloud & Application Layer.

Table I. Comparative Study With Related Work

Author	Parameters	µController	Smart system	Cloud platform	Storage for Future
A.Mondal, Z.Rehena	Temperature, soil moisture	Android UNO	Yes	Yes	Yes
Abdurrahman, G.M.Gebru and T.T.Bezabih	Soil Moisture	PIC16F887	Yes	No	No
P.A.Bhosale and V.V.Dixit	Temperature, soil moisture, Wind, Speed, Radiation and sunshine	PIC Microcontroller	Yes	No	No
J.Balendonc.k,et.al.	Temperature, soil moisture	Irrigation Controller (GP1,Delta-T)	Yes	No	Yes
B.Hanson and S.Orloff	soil moisture	No	No	No	No

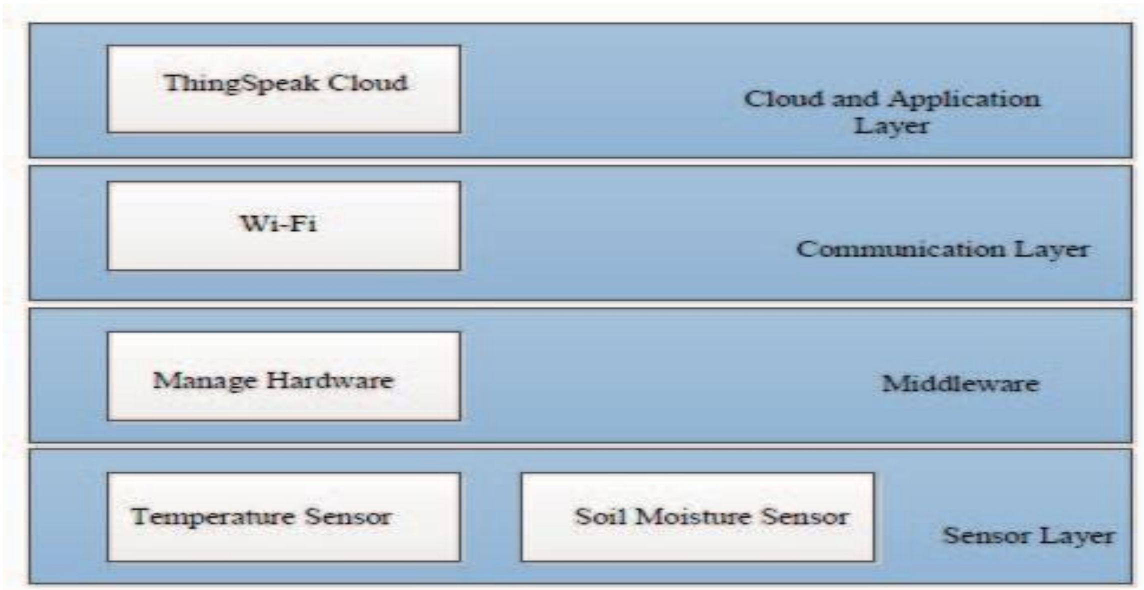

Fig. 1. Different layers of smart Farming System

2.1 Sensor Layer

This is the primary layer of our projected system. It's answerable for capturing and observation completely different environmental parameters. For sensing or assembling the parameters completely different sorts of sensors are deployed over the agriculture field. For this analysis work, 2 varieties of device have used: soil wetness sensor to watch soil wetness level and temperature sensor to watch temperature level among poly homes. These sensors are connected with Arduino primarily based microcontroller. The microcontroller connected with sensors fashioned basic IoT objects those are deployed over the agriculture field.

2.2 Middleware style

This is the second layer of our projected system. The middleware is required to automatize the farming method and it controls the actuators. It's to be designed for microcontroller. Detected values are fed into the microcontroller and relying upon the brink values of various parameters of observation field it acts consequently. This layer fastidiously monitors temperature and soil wetness level as these 2 parameters directly affects the crop yield and following selections are created.

- If soil wetness level is a smaller amount than the brink worth then microcontroller can activate the pump machine for watering the sector as inadequate moisture content in soil will decrease the crop production. Worth of soil wetness content is different for various varieties of soil [12]. The recommended threshold values of soil moisture content for different types of soil at that irrigation takes place are given in Table 1 consistent with [12].proposed system considers 15% soil moisture content as a threshold. Once the wetness level reaches the brink, pump can mechanically put off and therefore avoids spare wattage consumption.

- If temperature level is bigger than the brink worth then microcontroller can open the flap of the polyhouse. Projected system considers 40° C temperature as a threshold. Increase in temperature ends up in reduction in crop period and affects the equilibrium between crops and pests. It conjointly will increase the crop respiration rates and reduces the potency of fertilizers.

Except dominant the actuators, microcontroller sends the detected knowledge to the ThingSpeak cloud from the sector through a gateway.

2.3 Communication Layer

In this layer microcontroller communicates with the gateway wirelessly through Wi-Fi module because it provides advantage over Bluetooth. Bluetooth provides short vary communication than Wi-Fi as entree could also be distant from the observation field. LAN primarily based communication is avoided because of vast cabling. Here, microcontroller is provided with sensors deployed over observation field and causing the detected soil wetness and temperature worth to the cloud through a entree. Scientific discipline primarily based protocol is running on the entree. Microcontroller sends hypertext transfer protocol request to the ThingSpeak cloud for writing detected worth to the corresponding channel.

2.4 Cloud & Application layer

Cloud computing is an rising technology and might be used effectively in sensible farming. The projected model uses the cloud computing platform for recording completely different agricultural field knowledge. During this layer completely different channels are created, every corresponds to specific parameter field within the ThingSpeak cloud for storing field knowledge (temperature, soil moisture). Microcontroller sends the detected knowledge to the various channels sporadically through communication protocol. These knowledge (soil wetness worth, temperature value) are premeditated with relevance time and might be used for future analysis. Agricultural field standing (temperature, soil moisture) are often monitored remotely in terms of graph in ThingSpeak internet service. Applications are often created relating to farming that is deployed within the cloud and might be employed by farmers or researchers.

Table 1. Soil Moisture Content For Irrigation in Different Types of Soil

Soil Texture	Soil Moisture Content (%)
Sand	7
Loamy Sand	12
Sandy Loam	15
Silt Loam	20
Loam	23
Silty Claim Loam	28
Clay Loam	27
Sandy Clay Loam	24
Sandy Clay	22
Silty Clay	30
Clay	31

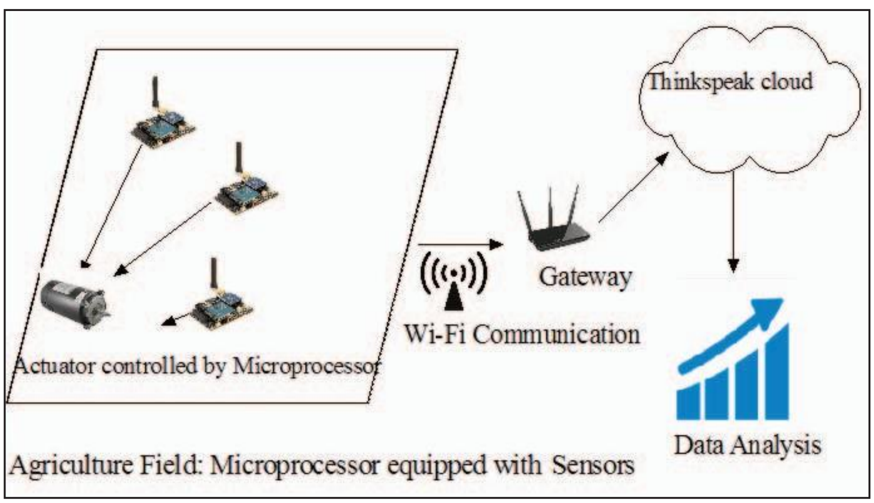

Fig. 2. System Deployment Model

3. EXPERIMENT AND RESULT

For realising the projected system, completely different equipments are getting used. Arduino UNO board is employed as a microcontroller and completely different sensors are connected with it. LM35 was used as a temperature device and VL95 used as a soil wetness sensor. Vessel motor, fan are connected with Arduino UNO board through vi pin relay to regulate high voltage device.

LM35 is Associate in nursing integrated-circuit temperature device and it's connected to analog pin of Arduino board. Output of LM35 device is linearly proportional to the centigrade temperature and therefore the measured worth is fed into the middleware within the Arduino board. Fig. 3 shows the experimental setup of this work.

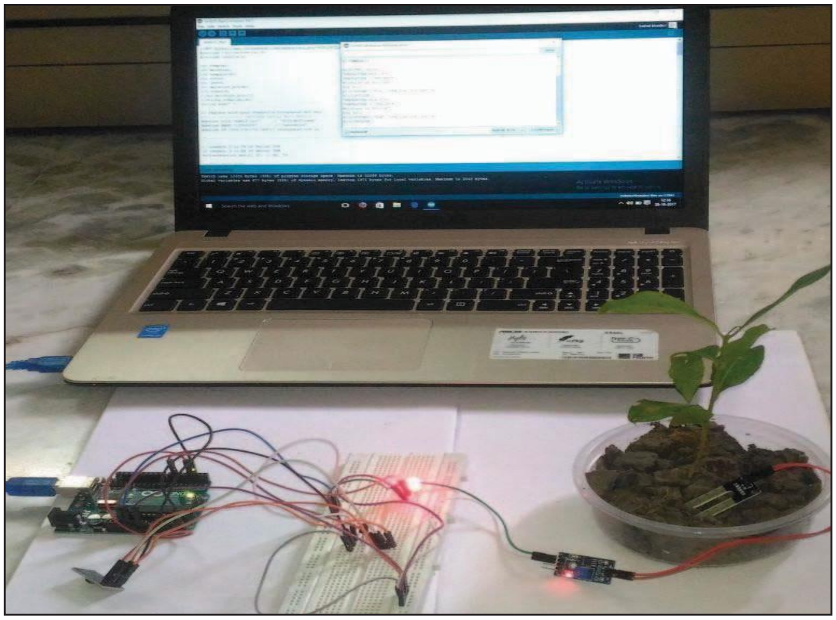

Fig. 3. Experimental Setup

VL95 uses 2 probes to pass current through soil and reads resistance to urge the soil wetness level. The measured values are fed into middleware within the Arduino board.

The detected environmental values are fed to the middleware within the Arduino board and supported these values middleware controls the mechanism (Controlling Pump, Fan). For coming up with middleware, Arduino IDE is employed.

Apart from dominant actuators mechanically, Arduino board send the measured parameters to the Cloud platform. Arduino board communicate with ThingSpeak cloud wirelessly through router for storing environmental parameters. Wi-Fi primarily based communication is employed during this model. ESP8266 module is employed as a Wi-Fi module. ESP8266 module connects with specific entree device having web property to speak to the Cloud.

Based on the experimental setup, the projected system has collected temperature and wetness of the soil from the observation field.

Then these detected values are premeditated in ThingSpeak internet service deployed in cloud setting in each fifteen seconds as ThingSpeak wants 15 seconds delay between updates. Fig. 4 shows field temperature worth with relevance time.

On the opposite hand, Fig. 5 represents graph supported soil wetness level with relevance time. Fig. 4. Field Temperature with relevance time Fig. 5. Soil wetness level with relevance time.

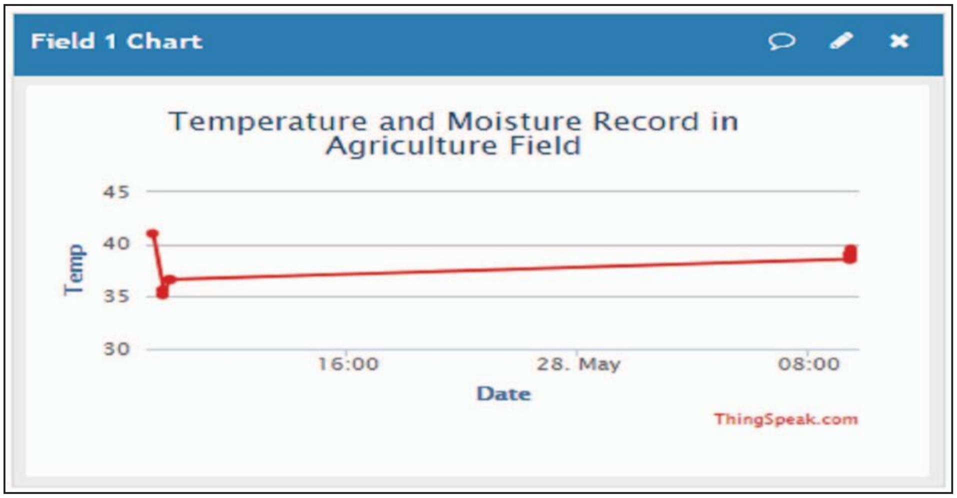

Fig. 4. Field Temperature with respect to time.

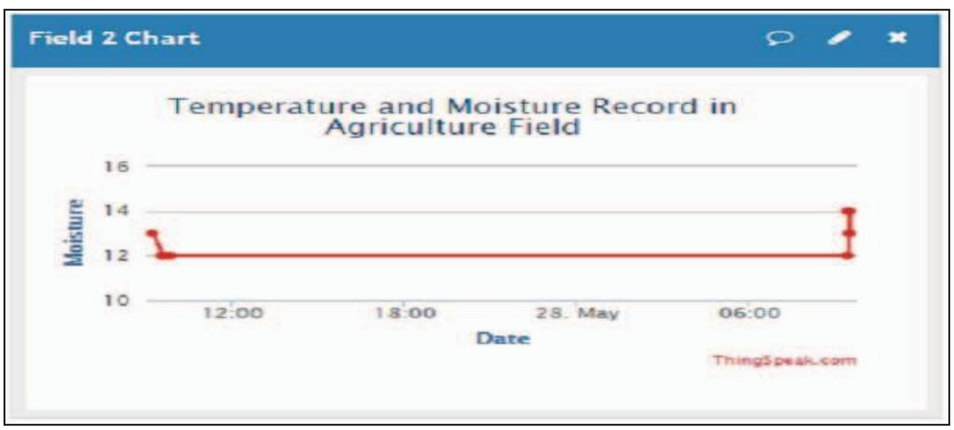

Fig. 5. Soil Moisture level with respect to time

4. CONCLUSION

Supported on top of mentioned system setup, completely different level of soil wetness and temperature worth were detected and supported predefined threshold value of soil moisture and temperature, Arduino board controls the high voltage farming equipments while not human intervention. Within the absence of soul in the agriculture field, this method provides continuous field observation and triggers the suitable events consistent with the necessity. It reduces the human effort and price of farming to a particular extent. For deploying the projected system in several quite soil texture setting mentioned in Table II, the brink worth of soil wetness and temperature has to amendment and might be incorporated by manually change the middleware.

Conjointly the system sends the environmental parameters values to the cloud from the sector in real time through wireless communication in each bound interval. These values are often used for future analysis and might be thought of for additional parameters to be monitored like organic phenomenon factors appreciate fungi, monera etc. for higher growth of the crop.

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