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# A Review of Different Parameter Monitoring Systems for Increasing Agricultural Yield

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***Abstract:*** ***In the past couple of decades, there is rapid growth in terms of technology in the field of irrigation. Different monitoring systems are installed in order to improve the yield. Monitoring unit monitors the various agricultural parameters like temperature, relative humidity, moisture, light detection, etc. and controlling unit controls the peripheral devices attached to the controller like valve, watering pump, etc. This paper reviews some of these monitoring systems and proposes an automatic monitoring system model using microcontroler, which may help the farmer to improve the yield.***

***Keywords: Agricultural, Microcontroller, Monitoring System, Wireless Sensor Network.***

## I. INTRODUCTION

Agriculture provides the basic platform for the economy of most of the countries. It is main source of livelihood of people. It provides not only food but also some important raw materials. The other advantage that agriculture provides is large scale employment. Indian economy largely depends on the earning from the field of agriculture and its associated allied fields. More than half of population work in agricultural sectors and depends on it.

Modernisation of agriculture is important because traditional way of farming is unable to boast up the yield rate in last few decades. Therefore recently farmers start to utilise the various technologies in the agricultural field in order to achieve higher yield and reduce the man power required. These technologies or monitoring systems help the farmer in proper utilisation of water. These automated systems need the dense structure of wireless sensor network (WSN). WSN are low cost, low power, small sensing devices used to collect data from different types of sensor, process it and communicate over wireless channel [1]. With the recent advancement in wireless sensor network as well as miniaturization of sensor boards, these low power sensors are available easily with very cheap rate [2]. Agricultural parameters are obtained by the sensors and collected data is send using WSN. This analog data is converted to digital and routed to the central monitoring unit either using single hop or by using multihop. Monitoring unit generally consist of mainly microcontroller. It will analysed the data and will display the real time values of different parameters. Earlier developed parameter monitoring systems are discussed in next section. Section III describes the proposed monitoring system model.

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## II. MONITORING SYSTEMS IN AGRICULTURE

It has been assumed that the yield rate in agriculture is not improving. So many researchers have studied different aspects of agriculture and came up with various monitoring systems which could help in increasing the yield. Some of the systems are summerised below.

The system proposed by G. Banerjee et. al. controlled the environment inside the polyhouse (metallic structure covered with polythene). It was two level system. First level was built outside the polyhouse. It had different components like liquid crystal display, switch relay circuitry, whereas the other level was developed inside polyhouse. It had different sensors, used to measure temperature and relative humidity. The sensor data was send to programmable interface controller (PIC) microcontroller using control area network (CAN) protocol. In the system, some references were set for temperature as $T_{min}$, $T_{max}$ and for humidity as $Rh_{min}$. Once the reference condition was exceeded then the controller would command to the relay operating circuitry so as to achieve proper controlling action. Various polyhouse could also be controlled simultaneously by connecting systems using CAN protocol.[3]

In one of the studies, a novel soil measuring system was explained. This system used hierarchical wireless sensor network for measuring soil parameters such as temperature and humidity. The sensors used were placed underground to collect soil measurement for transmitting the data, these sensor nodes use their radios. To maintain the long life and very low duty cycle, the system used a probabilistic communication protocol. The hierarchical structure of WSN is categorised as sensor node, relay node and base node. Sensors nodes were placed below ground for better judgment of soil condition. The collected information was send to relay node which directs the data to the nearby relay or base node directly consisting of 8051 microcontroller.[4]

An irrigation management model for higher crop yield was presented in 2010. It was based on some mathematical calculation used to estimate different agricultural parameters like water availability, soil compaction, biomass yield, etc of potato field, especially. This model consisted of structure of WSN which had intelligent humidity sensor, microcontroller and low power radio transreceiver for communication purpose. These nodes worked in either sensing or sleep mode.

They read soil water tension (SWT) value and sent it to base station, this data could be viewed or downloaded if necessary. Based on the value of SWT, the irrigation schedule could be modified.[5]

An innovative approach using cell phones was designed. This system was based on miscall and messages facility of cell phones. Specific duration of miscall was used as message/command and based on that the advance virtual RISC (AVR) sent the ON/OFF signal to the motor. Number of rings was set for an appropriate function. Miscall from system cell phone would be a message signal to farmer whereas miscall from farmer would command the microcontroller. This system could be modified for voice command instead of miscall for illiterate farmers.[6]

In one system Wi-Fi module was used to transmit information of various agricultural parameters like temperature, humidity, atmospheric pressure, moisture, water level and light detection. Corresponding sensors were used to measure these parameters and then converted values, using analog to digital converter (ADC), were sent to selected server via routers. It used comma separated values file format which was helpful in order to analyzed it and displaying purpose.[7]

A password protected water flow control system was explained using dual tone multi frequency (DTMF) technique. Communication between farmer and monitoring station was done using this DTMF technique. In this system, WSN was used along with circuit switching method for SMS purpose. Here, cell phone sent signal to DTMF to binary to decimal converter (BCD) using GSM module. Then 4 bit BCD signal was given to microcontroller 89C51. According to BCD code, it performed the controlling action on valves and water pumps.[8]

A closed loop automatic irrigation system was tried in the year 2012. It was used for monitoring temperature and water usage. The real time values of soil moisture and temperature were wirelessly transmitted, using ZigBee technology, to the substation which enforced the controlling action on the motor and the irrigation valve according to the preset values of moisture level as set by the user. Information like temperature, current soil moisture, motor status, water usage, etc was displayed on Liquid Crystal Display (LCD).[9]

A remote monitoring and control system was proposed, which controlled the connected devices using GSM module. It could be done by sending and receiving SMS on mobile phone. Instead of GSM, controlling action could also be performed using Bluetooth if application is in limited range of few meters. Different unexpected conditions like low water detection, temperature rise, etc were informed to user via SMS and user took the appropriate controlling action.[10]

An embedded system for drip irrigation was designed. The main theme of the system was to supply water drop by drop. By this way, water could effectively reached to the roots of crops. Water can be supplied with continuous or equally spaces openings that discharges water drop by drop. Irrigation system controlled the valve in order to maintain required amount of water. System also worked on the humidity and temperature precisely. Mainly advanced RISC machine (ARM) was used. In this wired system, entire field was divided into different sections and each contains tensiometer moisture sensor and temperature sensor. Hardy had the desired moisture level is reached then these underground sensors sent signal to microcontroller to turn off valve. Chemical injection unit was used to provide fertilizers and pesticides.[11]

In 2012 a microcontroller based irrigation system was developed. In traditional method of irrigation, unmeasured quantity of water was applied which results into excess watering or under watering. The main aim of the project was to make farmer aware of the present moisture level or the changing moisture level so that they can take the preventive measures. Moisture and temperature sensors were used and their output was fed to analog to digital converter and the digital signal was given to ARM controller. The data was checked with the upper threshold and lower threshold values and accordingly the controlling action on motor relay was performed.[12]

Different researchers have developed various monitoring systems as discussed above. Most of the systems have utilised WSN network which gives number of advantages like remote controlling, mobility, ease of design, etc. They have considered various agricultural parameters like moisture, humidity, temperature, light detection, pressure, etc. Monitoring of these parameters help the farmer to detect unfavorable environmental conditions inside the land. The brief summary of these monitoring systems is given in the Table No. I.

## III. SYSTEM COMPOSITION

The main aim of the systems explained above is to increase the yield. Another system is proposed for the same reason. Different types of sensors like temperature, humidity, moisture, etc. will be deployed in agricultural field. They will read the actual status of the field. These random analog values will be multiplexed and then transfer to analog to digital converter unit. Microcontroller will take these digital values via ZigBee. It will display the real time values of sensor readings on liquid crystal display. Day to day sensor information can be stored in EEPROM. Any unexpected variation in sensor reading shall be alarm on relay so that the necessary measures can be worked out.

Table No. 1 Different Parameter Monitoring Systems

| Brief Title of Paper | Monitored Parameter | Transmission | Monitoring | Controller | Mode Wired(W)/ Wireless(WL) |
|---|---|---|---|---|---|
| Polyhouse automation controller [3] | Temperature Humidity | - | Computer | PIC | W |
| A novel soil measuring WSN [4] | Temperature Humidity | IEEE 802.15.4 | Computer | 8051 | WL |
| WSN in agriculture [5] | Humidity | RF module | Computer | PIC | WL |
| Innovative approach for cell phone based embedded system[6] | Humidity Pressure Water Level | WiFi | Computer | WSN8024 | WL |
| WiFi based smart WSN for agri. environment [7] | Water Level | GSM / Bluetooth | Mobile Phone | AVR | WL |
| Remote irrigation system using DTMF code [8] | Moisture | GSM | Mobile Phone | 89C51 | WL |
| Closed loop Automatic irrigation system [9] | Temperature Moisture | ZigBee | Computer | ATMEL | W |
| Remote monitoring and control system using GSM-Bluetooth [10] | Moisture $CO_2$ level Humidity | GSM / Bluetooth | Mobile Phone | PIC | WL |
| Embedded system for drip irrigation [11] | Temperature Moisture | - | Computer | LM3ST36 | W |
| Microcontroller based irrigation [12] | Temperature Moisture | - | Computer | ARM | W |


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## IV. CONCLUSION

The advancement in engineering and technology over the last few decades has encouraged researchers to develop automatic monitoring and controlling system in agricultural field. Survey of some of the systems have been summarised. Use of WSN provides the mobilised controlled over the field. The earlier discussed systems can be modified to obtain higher yield and use of WSN, ZigBee, etc. will help to achieve better performance, optimised and economical system.

## REFERENCES

1. N. Shah and I. Das, "Precision irrigation: sensor network based irrigation", CTARA, Department Of Electrical Engineering, IIT Bombay, India, pp. 217-232,2010.
2. A. Baggio, "Wireless sensor networks in precision agriculture", Delft University of Technology, Netherlands, pp.1-2, May 2005.
3. G. Banerjee, R. Singhal, "Microcontroller based polyhouse automation controller", International Symposium on Electronic System Design, pp. 158-162, Dec 2010.
4. Q. Wang, A. Terzis, A. Szalay, "A novel soil measuring wireless sensor network", IEEE, pp. 412-415, 2010.
5. K. Shinghal, Dr. A. Noor, Dr. N. Srivastava, Dr. R. Singh, "Wireless sensor networks in agriculture: for potato farming", International Journal of Engineering Science and Technology, Vol. 2(8), pp. 3955-3963, 2010.
6. V. Ahmed, S. Ladhake, "Innovative cost effective approach from cell phone based remote controlled embedded system for irrigation", International Conference on Communication Systems and Network Technologies, pp. 419-144, 2011.
7. G. Mendez, M. Yunus, "A WiFi based smart wireless sensor network for an agricultural environment," International Conference on Sensing Technology, pp. 405-410, 2011.
8. V. Dubey, N. Dubey, S. Chouhan, "Wireless sensor network based remote irrigation control system and automation using DTMF code", International Conference on Communication Systems and Network Technologies, pp. 34-37,2011.
9. Neelam R. Prakash, Dilip Kumar, Tejender Sheoran, "Microcontroller based closed loop automatic irrigation system", International Journal of Innovative Technology and Exploring Engineering, pp. 4-6, June 2012.
10. S. Reddy, "Design of remote monitoring and control system with automatic irrigation system using GSM-Bluetooth", International Journal of Computer Aplication(0975-888), pp. 6-13,2012.
11. K.Prathyusha1, M. Chaitanya Suman, "Design of embedded system for the automation of drip irrigation", International Journal of Application or Innovation in Engineering & Management, pp. 254-258, 2012.
12. P. D. Hande, S. S. Kulkarni, "Microcontroller based irrigation", International Journal of Microcircuits and Electronic, pp. 1-6, 2012.

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