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Laboratory Automation System Using IOT Device

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Abstract: Agriculture has a major role in the overall economic prosperity of a nation. An important component of smart agriculture is the Internet of Things (IoT). This project aims to construct an automated agriculture system that maximizes crop consumption of water and fertilizer. This endeavor also include identifying animals and stopping trees. The goal of the project is to create more efficient ways to handle irrigation systems manually and automatically with a smart phone. The proposed system utilizes embedded devices, PROTEUS software, and MPLAB. The present study offers a comprehensive approach to the supervision and control of an intelligent irrigation and regulating system.

Keywords: Embedded systems, Smart Irrigation system, Smart Controlling system, Wireless sensor networks, sensors

I. INTRODUCTION

The core of the Indian economy is agriculture. Approximately 70% of people in India are employed in agriculture. The main issue facing many agricultural regions is the low level of mechanization in farming practices. The manual data collecting approach for necessary components would not be consistent and might result in variances due to poor measurement [1]. Differentiable wireless sensor nodes can cut down on the amount of time and energy needed to monitor the surroundings. Automation has the potential to eliminate a significant amount of the manual labor needed in agriculture. The Internet of Things (IoT) is a commonly utilized technology for data collection and device connectivity. The Internet of Things (IoT) is a shared network of items and things that, with an internet connection, may communicate with one another. By monitoring the effectiveness of the soil, fertilizer, water tank storage capacity, and theft detection in agricultural regions, we may anticipate a low-cost rise in output with Iot [2-4]. Water management and environmental monitoring are the two most crucial aspects of smart farming. Modern agriculture may result from combining time-tested practices with cutting-edge innovations like wireless sensor networks and the Internet of Things. The wireless sensor network uses wireless protocol to transfer data from several sensor kinds to the main server [6]. Our intelligent farming technology automates agricultural tasks and minimizes manual labor. This paper is organized as follows: section I. existing methods, section II proposed methods, section III materials and methods, followed by result in section IV and conclusion in section V.

II. EXISTING AGRICULTURAL AUTOMATION SYSTEM

This part illustrates the present method of monitoring and controlling agricultural fields.

2.1 IoT based monitoring system in smart agriculture

Because Internet of Things (IoT) sensors can provide information about agricultural areas, smart farming is an emerging idea. These systems employ automation and emerging technologies, such as the Internet of Things and smart agriculture. The main way to increase the yield of productive crops is to monitor environmental conditions.

This paper's characteristics include the use of sensors using a single CC3200 chip to monitor temperature and humidity in agricultural fields [5]. The traditional method of agricultural monitoring includes the following steps that are illustrated in the flowchart below:

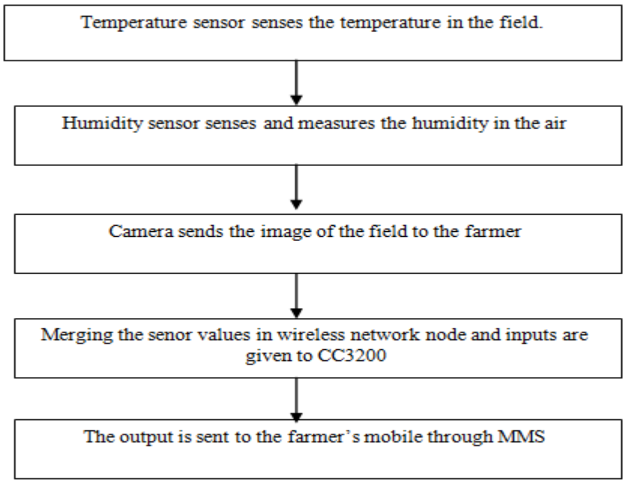

Fig.1 IoT Based monitoring system in smart agriculture

Although the field is monitored by cameras in this method, we are unable to determine the precise moisture level of the soil. As a result, the water level is not ideal.

2.2 Smart Farming System using sensors for agricultural task automation

This system's primary goal is to automate farming tasks by utilizing the principles of electronics, communication, and mechanics. A smart farm sensing system and a moveable smart irrigator that operates on a mechanical bridge slider arrangement are the two parts. This system is made up of an optocoupler, a moisture sensor, a spectroscopic sensor that measures light intensity, and a chlorophyll content sensor that determines how much nutrients are in the crops. The crane is comprised of two primary sensors, and an overhead crane equipped with a smart irrigator that allows for the analysis of crop development. The optocoupler linked to the compost, seeds, green manure, and water container is activated by sensors [7].

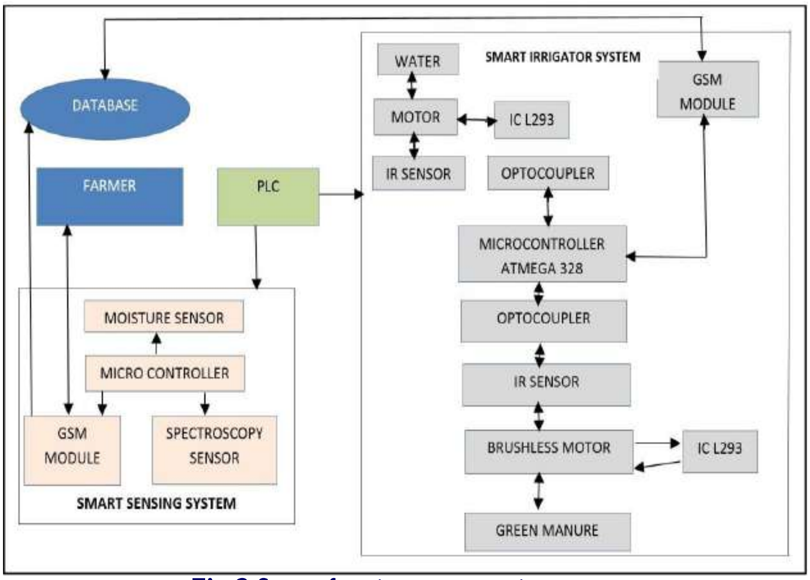

Fig 2 Smart farming system using sensor

1.1 Sensor data collection and irrigation control on vegetable crop using wireless sensor networks for smart farm

This system's research objective is to offer long-term, viable solutions for agricultural automation. A portable measuring technique comprising soil moisture, air humidity, and air temperature sensors was created by the system. These sensors were put by an irrigation system that used a wireless sensor network in order to gather environmental data and manage the irrigation system from a smartphone. Data was gathered by the microcontroller unit (MCU) from every sensor. The MCU will transform raw data into the proper transmission pattern as the environment changes. After the environment data was finished and prepared for transmission. To transmit information, the MCU will set up the serial connection and Xbee module.

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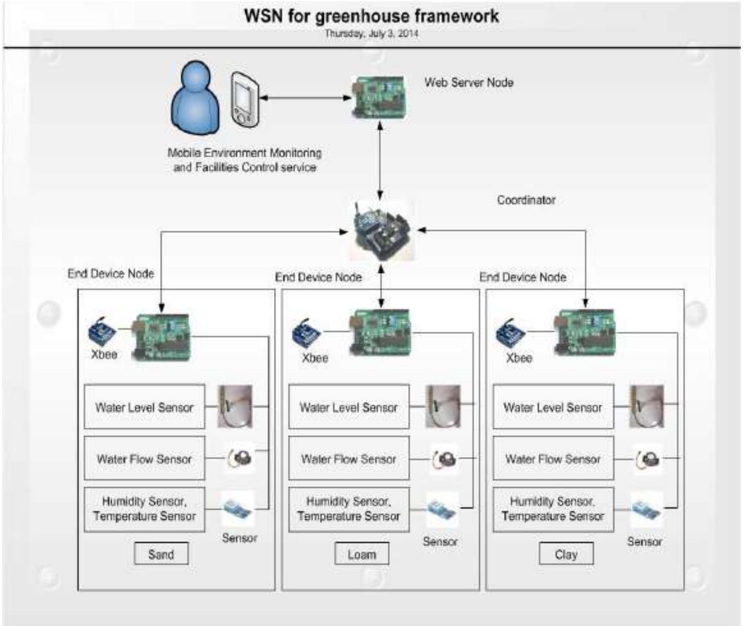

Fig 3 Sensor data collection and irrigation control

1.4 Remote agriculture automation using wireless link and IoT gateway infrastructure

The IoT gateway that runs the OPC UA server is connected to sensors and actuators in the system architecture for remote agricultural process automation. The benefit of this method is that it allows for easy modifications of control rules via cloud services (process controller installation or configuration) without requiring firmware updates for distant sensors or actuators. The appropriateness of wireless local networks for server requirements in remote automation tasks is the main subject of this research [8].

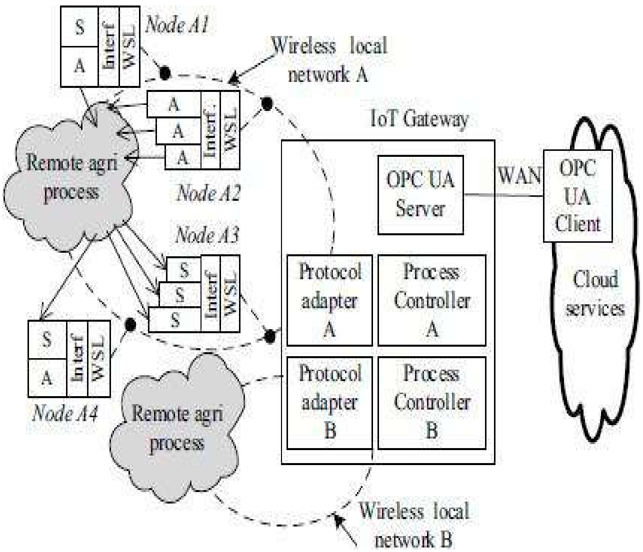

Fig 4 Remote agriculture automation

The system on display implements a data transport system between remote sensors and actuators using OPC UA server-based IoT gateway architecture to meet criteria for remote configurability and the separation of sensing/actuation devices from application control devices [9–10].

III. PROPOSED METHOD WORKING METHODOLOGY

Sensors including water flow, pH, PIR, and soil moisture sensors are used in the proposed system to monitor and regulate parameters. The sound of an axe and other equipment used to chop trees is recorded using a microphone in order to prevent trees from falling. In this case, IoT is used to convey the data. This system uses a PIC16F877A microcontroller to handle data. The Internet of Things, which is more defined by feel and measure than the Internet and mobile communication networks, is thought of as the third information technology paradigm. The block diagram for the suggested system concept is displayed in Fig. 5.

The working of this proposed technique is illustrated as follows:

- ✓ The soil moisture sensor detects and quantifies the soil's moisture content.
- ✓ When an animal is detected by the PIR sensor, a high-frequency sound signal is produced.

- ✓ To optimize the use of fertilizer, sensors for water flow and pH are utilized.
- ✓ After processing these data, the water pump's power supply is immediately turned on to provide the field with the ideal water level.
- ✓ The information will be sent to the user's mobile device via IoT, utilizing a unique IP address for the designated microcontroller. This microcontroller is configured to convey the data obtained from the sensor to the user via an online website that displays the current state of the field.

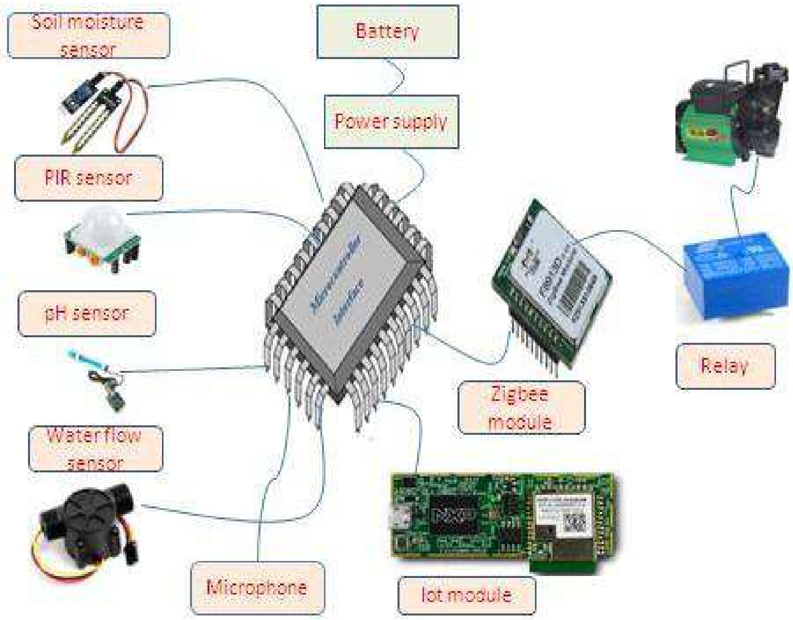

Fig 5 Block Diagram of the Proposed Method

IV. MATERIALS & METHODS

4.1 PIC Microcontroller

Microchip Technology produces the PIC line of microcontrollers. The term PIC stands for ―Peripheral Interface Controller‖ or ―Programmable Interface Controller‖. A CPU, memory, and peripherals are components of a standard microcontroller. This particular kind of microcontroller component is employed in the creation of robots, computers, and electronics and comparable apparatus.

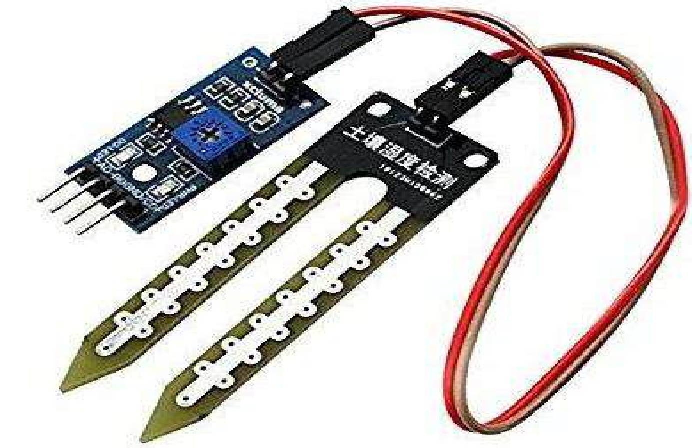

Fig 7 soil moisture sensor

PIC16F877A consists of five ports such as Port A, Port B, Port C, Port D, Port E and the inputs are connected to the required ports. It has an inbuilt analog to digital converter.

4.2 Soil moisture sensor

An essential factor in the formation of weather patterns and agricultural uses is soil moisture. A soil moisture sensor uses a volumetric approach to determine how much water is present in a medium, like soil. A soil moisture sensor is employed in this proposed study to determine the precise soil moisture conditions on the fields. Due to better control over soil moisture during important plant growth phases, farmers are able to enhance crop quality and yields while using less water overall.

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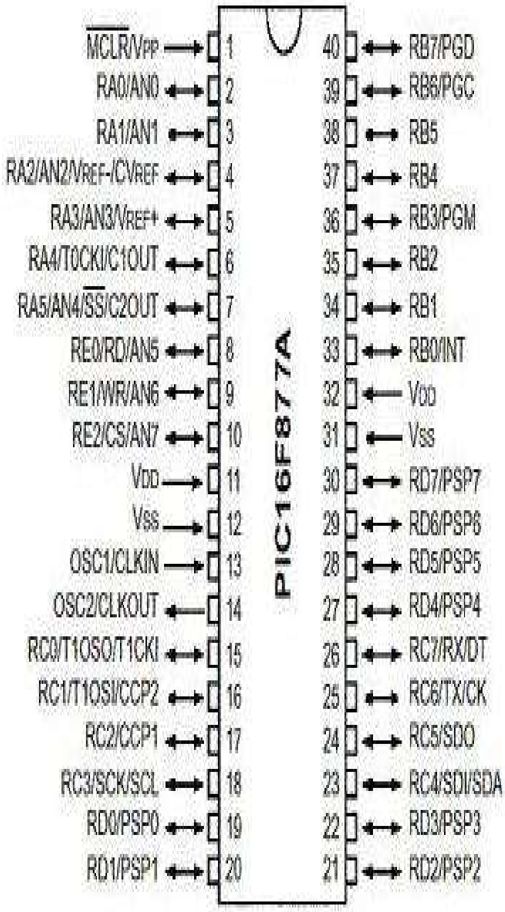

5 PIC MICROCONTROLLER

5.1 PIR sensor

Passive Infrared (PIR) sensors are employed in this suggested system to identify people and animals in the field. The most prevalent application for this kind is in motion sensing.

Fig 8 Passive infrared sensor

Automatic door openers and security alarm systems frequently employ them.Several places, including hospitals, supermarkets, and libraries, utilize PIR sensors as motion detectors.

5.2 pH sensor

The hydrogen-ion activity in water-based solutions is measured using a pH sensor, which expresses the solution's acidity or alkalinity as a pH value. The pH meter has a wide range of uses, from quality control to laboratory testing. pH sensors are employed in this suggested system to evaluate soil, crops, and water in agriculture in order to generate high-quality agricultural products. The gadget may run on line power or batteries, and its output can be either digital or analog.

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Fig 9 pH sensor

Using a pH sensor, we can monitor the growing environment and enhance the health and productivity of our crops.

5.3 Water flow sensor

A water rotor, a hall-effect sensor, and a plastic valve body make up a water flow sensor. The rotor rolls as water passes through it. Depending on the flow rate, the flow sensor's speed varies. The matching pulse signal is output by the hall-effect sensor. The water flow sensor in the suggested system is used to gauge how much fertilizer is combined with water. Farmers may use this to improve fertilizer consumption by receiving precise information about how fertilizers are blended with water. Applications for gas meters, chemicals, process auto-control, medical, food, and beverages are only a few examples.

6 HARDWARE RESULT

Figure 11 displays hardware findings that demonstrate animal identification, moisture level monitoring, and control. The soil moisture sensor detects and quantifies the soil's moisture content.

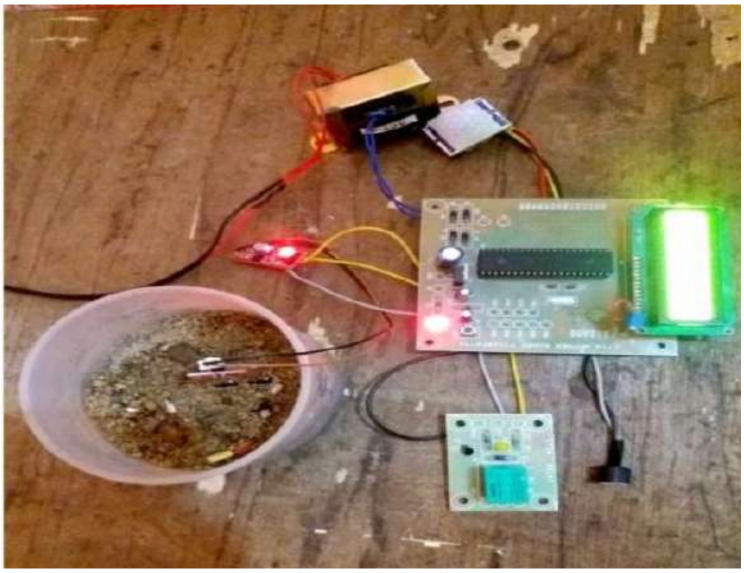

Fig 11 Hardware output

7 CONCLUSIONS & FUTURE ENHANCEMENTS

A novel agricultural automation system using the Internet of Things (IoT) is proposed after reviewing survey papers on intelligent farming, including IoT-based monitoring systems in smart agriculture, Smart Farming Systems using sensors for agricultural task automation, Sensor data collection and irrigation control on vegetable crop using smart phones and wireless sensor networks for smart farms, and Remote agriculture automation using wireless link and IoT gateway infrastructure. In the event that an animal poses a threat, this technology notifies the farmer and gives real-time information about the farmland. Additionally, the planned method forbids the unauthorized felling of trees. The upcoming improvements are listed below:

- ✓ Irrigation system can be monitored.
- ✓ Damage caused by predators is reduced.
- ✓ Increased productivity.
- ✓ Water conservation.

REFERENCES

[1]. Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar, ―IoT based Smart Agriculture‖ International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 6, ISSN (Online) 2278-1021 ISSN (Print) 2319 5940, June 2016.

[2]. Tanmay Baranwal, Nitika , Pushpendra Kumar Pateriya ―Development of IoT based Smart Security and Monitoring Devices for Agriculture‖ 6th International Conference - Cloud System and Big Data Engineering, 978-1-4673-8203- 8/16, 2016 IEEE.

[3]. Shihao Tang, Qijiang Zhu, Xiaodong Zhou, Shaomin Liu, Menxin Wu, ―A Conception of Digital Agriculture‖ (Research Center for Remote Sensing and GIS, Dept. Geography, Beijing Normal University & Beijing Key Laboratory for Remote Sensing of Environment and Digital Cities, Beijing, 100875).

[4]. Kaewmard, Nattapol ; Saiyod, Saiyan ―Sensor data collection and irrigation control on vegetable crop using smart phone and wireless sensor networks for smart farm‖, IEEE Conference on Wireless sensors (ICWiSE), DOI: 10.1109/ICWISE.2014.7042670 , Page(s): 106 – 112,2014

[5]. Angel, G. ;Brindha, A. ―Real-time monitoring of GPS-tracking multifunctional vehicle path control and data acquisition based on ZigBee multi-hop mesh network‖

[6]. Migdall, S.; Klug, P.; Denis, A; Bach, H., "The additional value of hyperspectral data for smart farming," Geoscience and Remote Sensing Symposium (IGARSS), 2012 IEEE International , vol., no.,pp.7329,7332, 22-27 July 2012

[7]. Eric D. Hunt., et al.2008. ―The development and evaluation of a soil moisture index.‖ Int. J. Climatol. Published online in Wiley InterScience. www.interscience.wiley.com.

[8]. Zhenyu Liao; Sheng Dai; Chong Shen, "Precision agriculture monitoring system based on wireless sensor networks," Wireless Communications and Applications (ICWCA 2012), IET International Conference on ,vol., no., pp.1,5, 8-10 Oct. 2012.

[9]. O.Vermesan, P.Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, -2013 (Internet access: http://www.internet-of-things-research.eu, Accessed:2015-02- 26).

[10]. Ning Wang, Naiqian Zhang, Maohua Wang, Wireless sensors in agriculture and food industry—Recent development and future perspective, Computers and Electronics in Agriculture 50 (2006) p. 1–14.

[11]. Ekins, S., & Bunin, B. A. (2013). The Collaborative Pharmaceutical Pipeline: Best Practices in Collaborative Drug Discovery (CDD) and the CDD Vault Interface. Assay and Drug Development Technologies, 11(7), 457-464.

[12]. Chow, S. L., & Ting, W. (2020). Lab Automation and Robotics: Automation on the Microscale. In Advances in Biochemical Engineering/Biotechnology, Vol. 172. Springer, Berlin, Heidelberg.

[13]. Riss, T. L., Moravec, R. A., Niles, A. L., Duellman, S., Benink, H. A., Worzella, T. J., & Minor, L. (2016). Cell Viability Assays. Assay Guidance Manual. Eli Lilly & Company and the National Center for Advancing Translational Sciences.

[14]. Hill, S., & Thompson, J. (2015). Laboratory Information Management Systems (LIMS): Transitioning to Data-Driven Research. Journal of the Association for Laboratory Automation, 20(1), 16-24.

[15]. Lequieu, J., & McDonnell, D. P. (2018). Lab Automation in Life Sciences Research. ACS Medicinal Chemistry Letters, 9(8), 747-750.

[16]. Riss, T. L., Niles, A. L., & Moravec, R. A. (2016). Automated High-Content Screening for Cell-based Assays. Assay Guidance Manual. Eli Lilly & Company and the National Center for Advancing Translational Sciences.