A Pico Microcontroller based IoT Device for Automation Agriculture and Irrigation Management

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***Abstract*:- Indian agriculture is diverse ranging from impoverished farm villages to developed farms utilizing agricultural technologies. Promoting application of modern information technology in agriculture will solve a series of problems facing by farmers. Lack of exact information and communication leads to the loss in production. Our paper is designed to overcome these problems. This system provides an intelligent monitoring platform framework and system structure for facility agriculture ecosystem based on IOT. Propose the IOT based smart agriculture model with Penta-sensor main aim at quality of water in the irrigation process.**

1.INTRODUCTION

As the world is trending into new technologies and implementations it is a necessary goal to trend up in agriculture also. Many researches are done in the field of agriculture. Most projects signify the use of wireless sensor network collect data from different sensors deployed at various nodes and send it through the wireless protocol. The collected data provide the information about the various environmental factors. Monitoring the environmental factors is not the complete solution to increase the yield of crops. There are number of other factors that decrease the productivity to a greater extent. Hence automation must be implemented in agriculture to overcome these problems.

The self-contained nature of operation, together with modular sized hardware platforms, scalable, and cost-effective technologies, has enabled the IoT as a potential tool towards the target of self-organized, decision making, and automation in the agriculture cum farming industry. In this regard, precision agriculture, automated irrigation scheduling, optimization of plant growth, farm land monitoring, and farming production process management in crops, are among a few key applications

2.LITERATURE SURVEY

2.1 A.Nurzaman, I.Hussain , Internet of Things (IoT) for Smart Precision Agriculture and Farming in Rural Areas (2019)

This paper presents the conceptual model and system design for decision support of smart farming with network sensor applications in order to perform necessary tasks required for farmers. We propose a comprehensive model using Internet of Things (IoT) approach which will be applied to agriculture. Data acquisition via sensors, control and tasks management, and data analysis are considered in the development of model and system design. In this system, we propose a solution to help farmers facing problems of tasks management and planning, environment factors measurements, and information distribution.

2.2 Chetan Dwarkani M, Ganesh Ram R, Jagannathan S, Priyatharshini R, Smart Farming System Using Sensors for Agricultural Task Automation (2019)

In this paper, we have proposed a novel methodology for smart farming by linking a smart sensing system and smart irrigator system through wireless communication technology. Our system focuses on the measurement of physical parameters such as soil moisture content, nutrient content, and pH of the soil that plays a vital role in farming activities. Based on the essential physical and chemical parameters of the soil measured, the required quantity of green manure, compost, and water is splashed on the crops using a smart irrigator, which is mounted on a movable overhead crane system. The detailed modelling and control strategies of a smart irrigator and smart farming system are demonstrated in this paper. Our Smart sensing system provides precise results and the Smart irrigator system manages to spray the necessary nutrients according to the requirements of the crops.

2.3 Narayut Putjaika, Sasimanee Phusae, Anupong Chen-Im, A Control System in an Intelligent Faming by using Arduino Technology(2020)

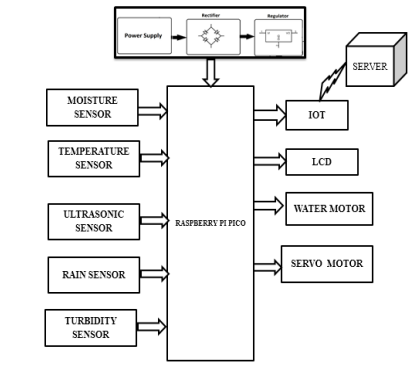
"Internet of Things" (loT) is a technology that allows things to communicate and connect with each other. This will change the patterns and processes in both industry and agriculture towards higher efficiency. Particularly, agriculture is an important foundation of Thai economy. Consequently, we propose an intelligent farming system (IF) to improve the production process in planting. IF composes of two main parts which are a sensor system and a control system. In this paper, we focus on the control part which are watering and roofing systems of an outdoor farm based on the statistical data sensed from the sensor systems (including temperature, humidity, moisture and light intensity sensors) Since the sensed data would not be always accurate due to

noises, we apply Kalman filtering to smooth the data before using as an input in our decision making process. For the decision making process, we do not consider only the sensed data, but also the weather information. A decision tree model is generated to predict the weather condition. Then, a set of decision rules based on both the sensed data and the predicted weather condition is developed to automatically make a decision on whether watering and roofing system should be on or off.

3.PROPOSED SYSTEM

The Project a Penta-Sensor based IoT System for Precision Agriculture and Irrigation Management using Raspberry pi forsmart crop field productivity. This system consists of sensor like moisture sensor, temperature sensor, rain sensor, pH sensor, turbidity sensor and ultrasonic sensor. Moisture sensor used for detecting the moisture content in soil, temperature sensor is used to measure the temperature value and ultrasonic sensor is used to measure the water level. If the water level is low, then water motor will ON. The rain sensor is used to detect rain and if the excess of water in field is detected, then motor will ON to remove it. This system also contains pH sensor to detect pH level of water and a turbidity sensor to identify the water turbidity. The measured parameters are uploaded to IOT through this farmer can monitor anywhere. Based on the command from IOT water motor will ON. These parameters are also displayed on LCD

3.1 Block diagram of proposed system



3.2.1 Pico micro controller

Raspberry Pi Pico is a low-cost, high-performance microcontroller board with flexible digital interfaces, built on silicon designed at Raspberry Pi. Key features include: RP2040 microcontroller chip designed by Raspberry Pi in the United Kingdom. Dual-core ARM Cortex M0+ processor, flexible clock running up to 133 MHz. Unlike the Raspberry Pi, which functions as a general-purpose computer and runs the popular Linux operating system, the Pico is a much more primitive device that lacks a central operating system and can only be programmed to perform specific tasks or control connected peripherals, usually as part of an embedded system or Internet of Things device.

3.2.2 Power supply circuit

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU

3.2.3 Moisture sensor

The **Moisture sensor** is used to measure the water content (moisture) of soil. When the soil is having water shortage, the module output is at high level; else the output is at low level. This sensor reminds the user to water their plants and also monitors the moisture content of soil. It has been widely used in agriculture, land irrigation and botanical gardening.

SPECIFICATION

- Working Voltage:**5V**
- Working Current:**<20mA**
- Interface type: **Analog**

3.2.4 Temparature sensor

A humidity sensor senses, measures and regularly reports the relative humidity in the air. It measures both moisture and air temperature. Relative humidity, expressed as a percent, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature can hold. The warmer the air is, the more moisture it can hold, so relative humidity changes with fluctuations in temperature.

3.2.5 Ultrasonic sensor

Ultrasonic transducers are the transducers that convert ultrasound waves to electrical signals or vice versa. Those that both transmit and receive may also be called ultrasound transceivers. These devices work on a principle similar to that of transducers used in radar and sonar systems which evaluate attributes of a target by interpreting the echoes from radio or sound waves. The technology can be used for measuring wind speed and direction, tank or channel level, the sensor measures the distance to the surface of the fluid.

3.2.6 Rain sensor

A ran sensor is one kind of switching device which is used to detect the rainfall. It works like a switch and the working principle of this sensor is, whenever there is rain, the switch will be normally closed. The module is similar to LM393 IC because it includes the electronic module as well as a PCB. Here PCB is used to collect the raindrops. When the rain falls on the board , then it creates a parallel resistance path to calculate through the operational amplifier. This sensor is resistive dipole, and based on the moisture only it shows the resistance.

3.2.7 Turbidity sensor

The turbidity sensor directs a focused beam into the monitored water. The light beam reflects off particles in the water, and the resultant light intensity is measured by the turbidity sensor's photo detector. The light intensity detected by the turbidity sensor is directly proportional to the turbidity of the water. The turbidity sensor utilizes a second light detector to correct for light intensity variations and colour changes.

4.WORKING PRINCIPLE

In this we use the PICO microcontroller which is cost efficient and as well as produce best output. A node MCU which is a Wi-Fi SOC (System On Chip). It is

ESP8266-12E Wi-Fi based module which isthe main component of the project. The Wi-Fi module present in the node MCU is pared with mobile phones, laptops or desktops to get access about changes occurring in the sensors through the IoT application BLINKY which is used here. This project includes various sensors like temperature, moisture, rain, ultrasonic, turbidity sensors and two motorssuch as servo motor and water control motor. The IoT setup when placed in the field, the temperature and moisture sensors record the daily change in temperature and moisture level in the soil. If the field gets rained there occurs the excess water in the field. Once the rain sensor detects the rain water the servo motor gets open and flushes out the excess water present in the field. If the temperature and moisture level become low than the threshold value then the water motor turns on and send the water into the field. The ultrasonic sensor present is used to record the water level in the tank.If the water level in the tank goes down the threshold value, then the water control motorgets on. Turbidity sensor is used to detect the impure water. When the turbidity sensor is placed in the water containing source if the water is impure the bulbs present in the sensor gets glow and shows the water is impure in the LCDBased on the automated system, the system monitors and check for the 4 different conditions with those 4 sensors.

1.Rain water (excess water on filed detected): The servo motor is set to ON to flush out the water.

2.If the soil temperature>threshold value then the water control motor is on the water is flushed into the field

3. If the soil moisture >threshold value, water is flushed into the field using the water control to make the soil at its required moisture content.

4. If the tank level>threshold value then there is lack of water, so the motor is set to on.

In this the threshold value for temperature is 40 in degree Celsius and moisture is 70. When the values of temperature and moisture went down to the threshold values in those recorded days the water motor is continuously on and the water is flushed into the field

The rain sensor which is interfaced with the PICO microcontroller has a contact with the servo motor. If there occurs excess water than the required water content in the field the rain sensor detects it and the servo motor will on to flushes the water outside the field

5 RESULTS AND DISCUSSION

HARDWARE RESULT

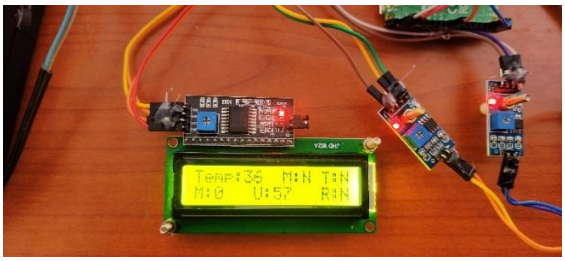


Fig.1. Recorded values shown in LCD

SOFTWARE RESULT

The hardware setup of the project. In this we use the PICO microcontroller which is cost efficient and as well as produce best output. A node MCU which is a Wi-Fi SOC (System On Chip). It is ESP8266-12E Wi-Fi based module which isthe main component of the project. The Wi-Fi module present in the node MCU is pared with mobile phones, laptops or desktops to get access about changes occurring in the sensors through the IoT application BLINKY which is used here. This project includes various sensors like temperature, moisture, rain, ultrasonic, turbidity sensors and two motorssuch as servo motor and water control motor. The IoT setup when placed in the field, the temperature and moisture sensors record the daily change in temperature and moisture level in the soil. If the field gets rained there occurs the excess water in the field. Once the rain sensor detects the rain water the servo motor gets open and flushes out the excess water present in the field. If the temperature and moisture level become low than the threshold value then the water motor turns on and send the water into the field. The ultrasonic sensor present is used to record the water level in the tank. If the water level in the tank goes down the threshold value, then the water control motor gets on. Turbidity sensor is used to detect the impure water. When the turbidity sensor is placed in the water containing source if the water is impure the bulbs present in the sensor gets glow and shows the water is impure in the LCD.

6. CONCLUSION AND FUTURE WORK

IOT based smart agriculture system can prove to be very helpful for farmers since over as well as less irrigation is not good for agriculture. Threshold values for climatic conditions like humidity, temperature, moisture can be fixed based on the environmental conditions of that particular region. This system generates irrigation schedule based on the sensed real time data from field and data from the weather repository. This technology can tell a farmer about the irrigation necessity and also can determine the quality of water. All observations and experimental tests proves that project is a complete solution to field activities and irrigation problems with remote control and monitoring respectively. Implementation of such a system in the field can definitely help to improve the yield of the crops and overall production

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