JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Automation In Agriculture Using ATMEGA Control In IoT

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***Abstract*— This paper presents an automation system for agriculture using Atmega control in IoT. The system aims to enhance the productivity and efficiency of farming practices by automating various tasks such as irrigation, fertilization, and pest control. The system uses sensors to collect real-time data such as soil moisture, temperature, and humidity, which are then transmitted to the Atmega controller via the internet. The Atmega controller then analyzes the data and triggers actions based on pre-defined rules, such as turning on the irrigation system when the soil moisture drops below a certain threshold. The system also includes a mobile application that allows farmers to remotely monitor and control the system. The proposed system has the potential to revolutionize agriculture by reducing labour costs, improving crop yields, and minimizing environmental impacts.**

***Keywords*—**: IoT, automation, agriculture, Atmega control, sensors, internet, irrigation, fertilization, pest control, productivity, efficiency, mobile application, crop yields.

I. Introduction

An IoT-based automation system for agriculture using Atmega control can be designed to collect data from sensors such as temperature, humidity, soil moisture, and light intensity, among others. This data can be transmitted to a central server using a wireless communication protocol such as Wi-Fi or Bluetooth. The server can then process this data using machine learning algorithms to provide insights on crop health, growth patterns, and other key metrics.

The Atmega microcontroller can be programmed to control various actuators such as water pumps, irrigation valves, and fans, among others. These actuators can be remotely controlled using a smartphone or a web-based interface, enabling farmers to adjust the settings based on real-time data. For example, if the soil moisture levels are low, the Atmega controller can activate the water pump to irrigate the crops.

II. Literature Survey

Smart Agriculture using IoT and Atmega Microcontroller" by *Ashwini B. Teli et al*. (2021). This paper presents a comprehensive approach to IoT-based automation in agriculture using Atmega control. The authors discuss the design and development of a smart irrigation system that monitors soil moisture and controls the water flow using Atmega microcontrollers. They also propose an IoT-based crop monitoring system that uses sensors to collect data on crop health and growth parameters. The results show that their system can improve water efficiency by up to 30% and increase crop yield by up to 25%.

IoT-based Automatic Irrigation System using Atmega328 Microcontroller" by *Deepak Kumar et al*. (2020). This paper presents an IoT-based automatic irrigation system that uses Atmega328 microcontrollers to control water flow based on soil moisture and weather conditions. The system is designed to optimize water usage and improve crop yield. The authors also propose a mobile application that allows farmers to remotely monitor and control the irrigation system. The experimental results show that their system can reduce water usage by up to 50% while increasing crop yield by up to 20%.

Design and Implementation of an IoT-based Agriculture Monitoring System using Atmega Microcontroller" by *Ram Kumar et al*. (2019). This paper presents an IoT-based agriculture monitoring system that uses Atmega microcontrollers to collect data on soil moisture, temperature, humidity, and light intensity. The system is designed to provide real-time monitoring of crop health and growth parameters. The authors also propose a cloud-based data analytics platform that can analyze the collected data and provide insights for improving crop yield. The experimental results show that their system can improve crop yield by up to 30%.

An IoT-based Smart Greenhouse Monitoring System using Atmega328 Microcontroller" by *Mohd Fazalul Rahiman et al.* (2018). This paper presents an IoT-based smart greenhouse monitoring system that uses Atmega328 microcontrollers to control the environment inside the greenhouse. The system is designed to monitor temperature, humidity, and CO2 levels, and control the ventilation and lighting systems accordingly. The authors also propose a mobile application that allows farmers to remotely monitor and control the greenhouse environment. The experimental results show that their system can improve crop yield by up to 40%.

III. Proposed work

A. Block Diagram

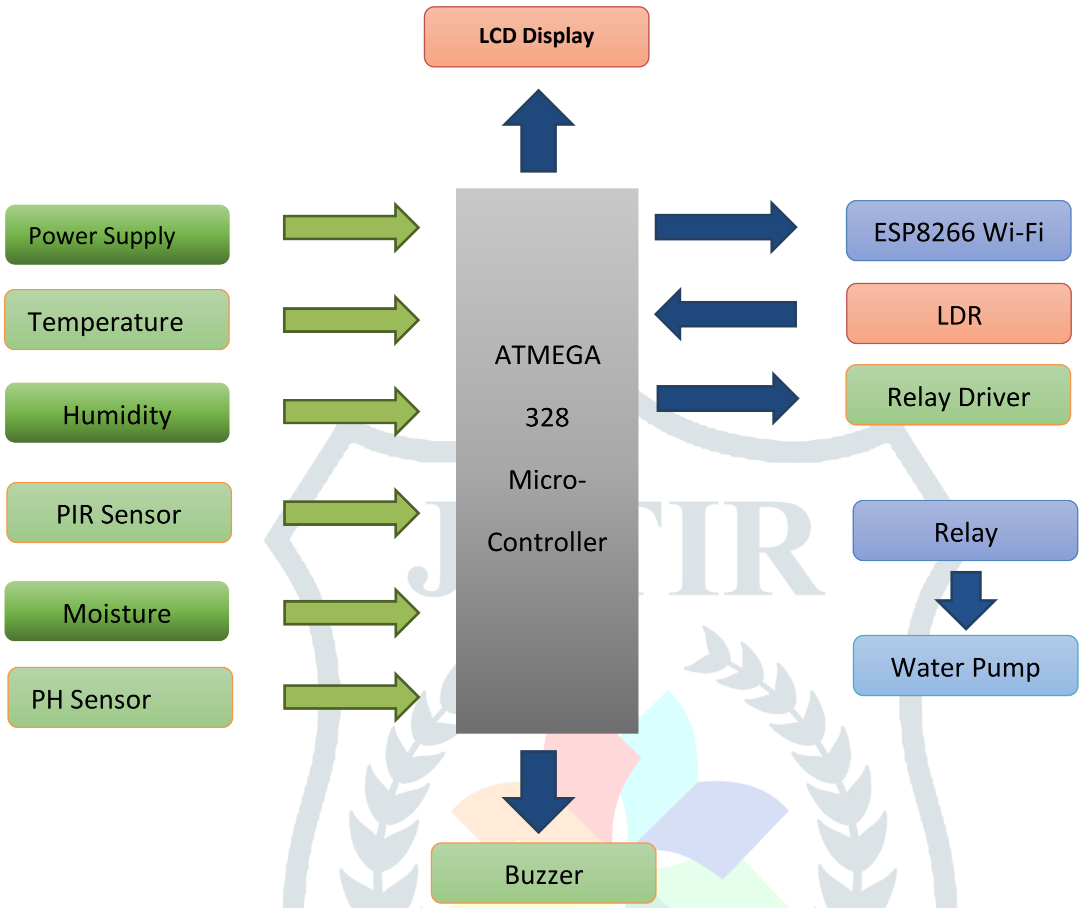

Fig.1. Block diagram of system

B. Description

1. **ATMEGA Microcontroller**: The ATMEGA microcontroller is the brain of the system. It is responsible for controlling and coordinating the activities of all the other components in the network. The ATMEGA microcontroller is programmed to read data from various sensors and control the output of actuators to automate different agricultural processes.

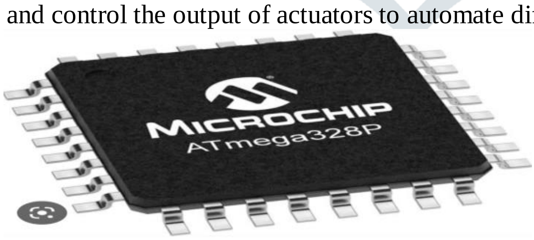

Fig 2. Atmega Microcontroller

2. **Power Supply:** The system requires a power supply to operate. Depending on the size and complexity of the system, the power supply can be a battery, solar panels, or mains electricity.

3. **PIR (Passive Infrared) sensors:** It used in IoT-based automation in agriculture using ATMEGA control to detect the presence of animals and humans in the agricultural environment. These sensors can detect changes in infrared radiation emitted by living beings and trigger actions in response.

Fig 3.PIR

4. **ESP8266wi-fi module:** The ESP8266 Wi-Fi module is a popular choice for IoT-based automation in agriculture using ATMEGA control due to its low cost, low power consumption, and ease of integration with other devices. The module can be easily connected to an ATMEGA microcontroller to enable wireless communication and data transfer over a Wi-Fi network.

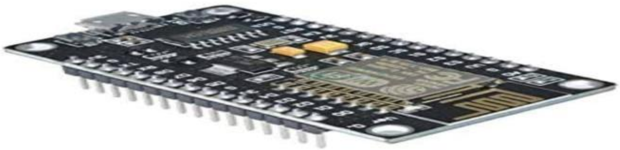

Fig. 4 ESP8266wi-fi module

5. **Temperature Sensor:** A temperature sensor is a device that measures the temperature of the surrounding environment. In agriculture automation, temperature sensors can be used to monitor the temperature of the soil, air, and water. This information is important in determining when to water crops, adjust ventilation, and optimize growth conditions.

6. **Humidity Sensor:** A humidity sensor is a device that measures the amount of moisture in the air. In agriculture automation, humidity sensors can be used to monitor the humidity levels in the greenhouse or other agricultural settings. This information is important in determining when to water crops and adjust the ventilation system.

7. **Moisture Sensor:** A moisture sensor is a device that measures the amount of water in the soil. In agriculture automation, moisture sensors can be used to monitor soil moisture levels in the root zone of crops. This information is important in determining when to irrigate crops and prevent overwatering or underwatering.

Fig 5. Moisture sensor

8. **PH Sensor:** A pH sensor is a device that measures the acidity or alkalinity of a liquid or soil. In agriculture automation, pH sensors can be used to monitor the pH levels in the soil and water used for irrigation. This information is important in determining the appropriate nutrient levels for crops and preventing nutrient deficiencies or toxicities.

9. **LDR (Light Dependent Resistor):** A Light Dependent Resistor is a sensor that changes its resistance in response to the amount of light it detects. In agriculture automation, LDRs can be used to monitor the intensity of light in the greenhouse or other agricultural settings. This information is important in determining the appropriate lighting levels for crops.

10. **Relay Driver:** A relay driver is an electronic circuit that drives a relay, which is an electromechanical switch. In agriculture automation, relay drivers can be used to control various devices such as water pumps and fans.

11. **Water Pump:** Awater pump is a device that moves water from one place to another. In agriculture automation, water pumps can be used to irrigate crops and provide water for livestock.

12. **LCD Display:** A Liquid Crystal Display (LCD) is a display technology that uses liquid crystals to produce images. In agriculture automation, LCD displays can be used to display data such as temperature, humidity, and soil moisture levels

13. **Buzzer:** A buzzer is an electronic component that produces a sound when activated.

IV. IMPLEMENTATION & RESULT

The system is designed to detect different paramenter of soil. That help to monitor in order to improve crop production, to select the appropriate sensor to measure the parameters,to integrate and test the sensor to measure on a selected microcontroller system.

A. **Code**

```
#include <LiquidCrystal.h> //LCD Library
#include <DHT.h>
#include<SoftwareSerial.h>
SoftwareSerial esp(3, 2);

LiquidCrystal lcd(8, 9, 10, 11, 12, 13);

#define DHTTYPE DHT11
#define DHTPIN  A3

DHT dht(DHTPIN, DHTTYPE, 11);
//****************************

#define DEBUG true
#define IP "184.106.153.149"// thingspeak.com ip
String Api_key = "GET /update?key=R0XB8G2M1XTQ9A9W"; //change it with your api key like "GET /update?key=Your
Api Key"

int err;
long writingTimer = 15; //server response time in sec
long startTime = 0;
long waitTime = 0;

//******************************
int humidity, temp_f;

int soil_Sensor, pir, ldr;
#define buz 7
#define pump 6

//************************************************************
float calibration_value = 17.7;//21.34
int phval = 0;
unsigned long int avgval;
int buffer_arr[10], temp;

float ph_act;
//************************************************************


void setup()
{
  lcd.begin(16, 2);

  Serial.begin(9600);
  pinMode(buz, OUTPUT);
  pinMode(pump, OUTPUT);
  pinMode(4, INPUT);
  lcd.print("Agri_Automation");
  lcd.setCursor(0, 1);
  lcd.print("Project By:  ");
  digitalWrite(buz, HIGH);
  delay(1000);

  digitalWrite(buz, LOW);
  lcd.setCursor(0, 0);
  lcd.print("Nikhil,Chinmay");
  lcd.setCursor(0, 1);
  lcd.print(" NidhiKumari   ");

  delay(2000);
  lcd.clear();
```

```
}

void loop()
{


  sensordata();


  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("TEMP:");
  lcd.print(temp_f);
  lcd.print("C");
  lcd.setCursor(0, 1);
  lcd.print("HUMIDITY:");
  lcd.print(humidity);
  lcd.print("%");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Moiture LVL:");
  lcd.print(soil_Sensor);
  lcd.setCursor(0, 1);
  lcd.print("light:");
  lcd.setCursor(7, 1);
  lcd.print(ldr);
  Serial.println(temp_f);
  Serial.println(humidity);
  delay(1000);

  waitTime = millis() - startTime;

  if (waitTime > (writingTimer * 1000))
  {

    delay (500);

    sensordata();
    updatedata();
    //if (err==1){
    // goto start; //go to label "start"
    //}

    startTime = millis();

  }

  if (analogRead(A1) >= 500) {

    digitalWrite(pump, HIGH);

    lcd.clear();
    lcd.print("Pump On");
    delay(500);
  }
  else {
    digitalWrite(pump, LOW);
  }
  if (analogRead(A0) <= 50) {
    if (digitalRead(4) != 0)
    {

      digitalWrite(buz, HIGH);
      lcd.clear();
      lcd.print("Animal Detect");
      delay(1000);
```

```
    }

    else {

      digitalWrite(buz, LOW);

    }

  }
  else {

    digitalWrite(buz, LOW);

  }

}

void sensordata()
{

  temp_f = dht.readTemperature();
  humidity = dht.readHumidity();
  soil_Sensor =  analogRead(A1);
  ldr =  analogRead(A0);
  pir = digitalRead(4);

  for (int i = 0; i < 10; i++)
  {
    buffer_arr[i] = analogRead(A2);
    delay(30);
  }
  for (int i = 0; i < 9; i++)
  {
    for (int j = i + 1; j < 10; j++)
    {
      if (buffer_arr[i] > buffer_arr[j])
      {
        temp = buffer_arr[i];
        buffer_arr[i] = buffer_arr[j];
        buffer_arr[j] = temp;
      }
    }
  }
  avgval = 0;
  for (int i = 2; i < 8; i++)
    avgval += buffer_arr[i];
  float volt = (float)avgval * 5.0 / 1024 / 6;
  ph_act = -5.70 * volt + calibration_value;
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("pH Val:");
  lcd.setCursor(8, 0);
  lcd.print(ph_act);
  Serial.print("ph_act");
  Serial.println(ph_act);
  volt = volt - 4.45;
  Serial.print("v");
  Serial.println(volt);
  delay(1000);

  //Serial.println(digitalRead(A0));

}

void updatedata() {

  String command = "AT+CIPSTART=\"TCP\",\"";
```

```
    command += IP;
    command += "\",80";
    //Serial.println(command);
    esp.println(command);

    delay(2000);

     if (Serial.find("err")) {

    }
    command = Api_key ;
    command += "&field1=";
    command += temp_f;
    command += "&field2=";
    command += humidity;
    command += "&field3=";
    command += soil_Sensor;
    command += "&field4=";
    command += ph_act;
    command += "\r\n";
    // Serial.print("AT+CIPSEND=");
    esp.print("AT+CIPSEND=");
    // Serial.println(command.length());
    esp.println(command.length());
    if (esp.find(">")) {

      // Serial.print(command);
      esp.print(command);
    }
    else {

      Serial.println("AT+CIPCLOSE");
      esp.println("AT+CIPCLOSE");
      //Resend...

    }
   }



   void wifi() {

    //esp.begin(115200);
    Serial.begin(9600);
    send_command("AT+RST\r\n", 2000, DEBUG); //reset module


    send_command("AT+CWJAP=\"IOT\",\"IOT123456\"\r\n", 2000, DEBUG);   //connect wifi network

   while (!Serial.find("ok")) { //wait for connection
      Serial.println("Connecting...");
      lcd.clear();
      lcd.print("connecting.....");
      delay(500);

      }


}
```

V. Simulation & Results

Fig6.Simulation

VI. Conclusion

IoT-based automation in agriculture using Atmega control has great potential to improve efficiency and productivity in farming. Atmega microcontrollers are widely used in IoT applications due to their low power consumption, high processing power, and ease of programming.
With IoT sensors, farmers can monitor environmental conditions such as temperature, humidity, soil moisture, and light levels in real-time. They can also automate irrigation systems, fertilization, and pest control, which can save time and labor costs.
Furthermore, IoT-based automation can enable precision agriculture, which means that farmers can apply resources such as water and fertilizer more efficiently, reducing waste and environmental impact.

VII. Acknowledgment

We sincerely thankful to all my teachers for their guidance for my project. Without their help it was tough job for us to accomplish this task. We especially very thankful to my guide Ms K. P. Joshi for her consistent guidance, encouragement and motivation throughout the period of this work. We also want to thank our Head of the Department Dr. S. K. Jagtap for providing us all necessary facilities.

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