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Software implementation for Smart Green House Effect controller for Indian Farmers

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ABSTRACT: This paper is about software implementation of the smart greenhouse monitoring and controlling using IoT. Here in this paper, we have discussed the embedded software data flow and web application data and usage flow. Our system has 2 types of nodes first is sensor node another is actuator node, while software has three level of user access to data starting form Admin user have overall access to software, government User have no user creation access rest all software accessible to government user and last is farmer user which have limited control over software.

KEYWORDS: IoT, Software Implementation, Greenhouse, DBMS, WSN.

I. INTRODUCTION

The natural effect by which earth surface get warms by absorption of reflected infrared radiation of Earth's surface is keyed as greenhouse effect that encounters the direct result on warming atmosphere of earth that maintains temperature of the dark side of earth with while sun is on other side. The trend was discovered by J. Fourier as early as 1827 and firstly quantified by S. Arrhenius in 1896[1]. Initially solar radiation around 23% is being absorbed by ozone, dust, and water vapor, 29% is being reflected-back to space by bright bodies of earth such as sea, snow, cloud while 48% is being absorbed by earth surface. Thus around 71% of sun radiation are absorbed by earth. Now, here the greenhouse gets started sun Earth surface starts radiating this stored energy in form of IR radiation a very less amount of IR radiation is being cross the earth atmosphere and pass through it while rest is reflected and scattered in all directions due to clouds and molecules of greenhouse gases it finally results in warming up of lower atmosphere of earth and this natural phenomenon is described as Greenhouse effect. Geology and Earth Science Dictionary described the greenhouse other words as – "The effect of heat retention in the lower atmosphere because of absorption and reradiation by clouds and gases of long-wave [4]. The greenhouse effect controller hardware unit is discussed in previous paper presented by developer entitled as An Intelligent Controlling and Monitoring of Green House Effect for Indian Farmers [6].

II. SOFTWARE DATA FLOW

As we all have previously discussed that there are two major parts in software designing first is embedded system software program that has been stored in microcontroller memory while other is controlling / monitoring web application that has been stored over a server for global access of data. Figure 1 and Figure 2 shows the flow chart of embedded system programming figure 1 shows the sensor node and figure 2 shows the actuator node operation. As the system starts both the nodes first try to connect to Wi-Fi and waits until it gets connected and similarly it waits to connect with the server, after connecting with server sensor node starts sending environmental parameters to server while actuator node reads the predefined and current environmental parameters and actuate physical devices accordingly it also checks if manual mode of operation is active or not if manual mode and performs as required. Let us consider a case if moisture level of soil gets down to predefined level of moisture actuator node is responsible for turning on the pump and maintain the soil moisture level.

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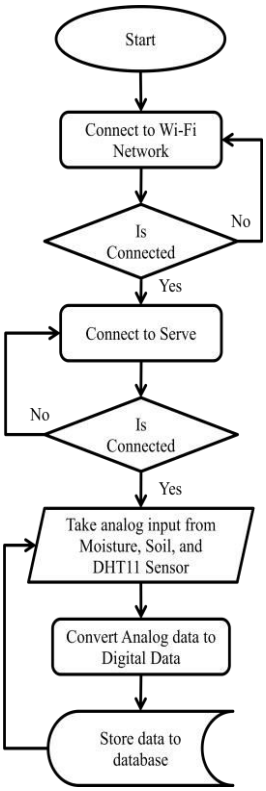

Figure1 Sensor Node Software flow chart

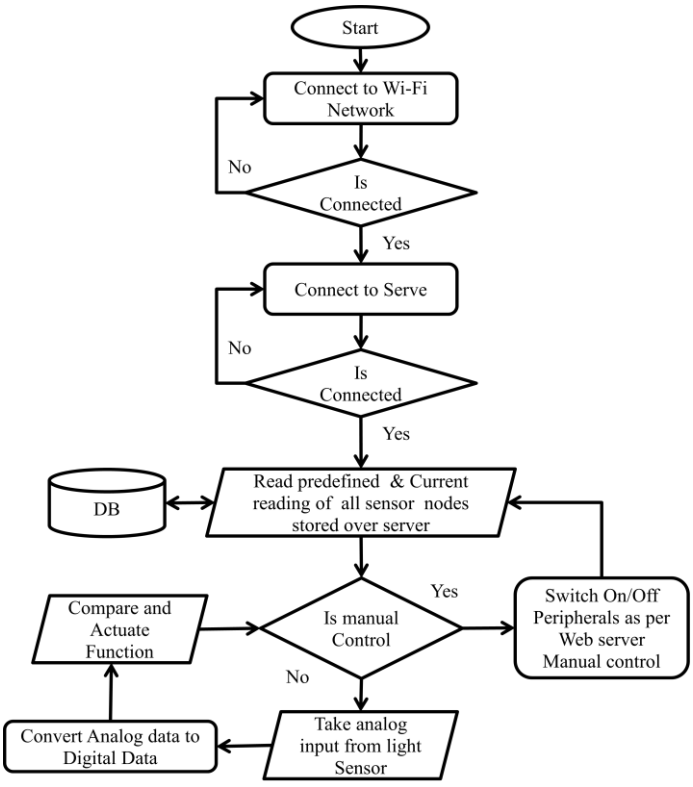

Figure 2 Actuator Node software flow chart

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III. PROPOSED ALGORITHM

The proposed algorithm for sensor and actuator node is as follows

A. *Sensor Node Algorithm:*

```
Setup ( )
{
        Initialize_wifi_component ();    //Wi-Fi  Variables.
        Initialize_server_component ( );          // Server Variables.
        Initialize_global_component (); //Rest Variables.
        Initialize_digital_pins ();               //Digital i/o Pins
        While (Wifi_Not_Connected)   // Wait till the wifi gets connected
        {  Connect_to_wifi_host ( ); }
}
Loop ( )
{
    Read_soil_moisture ( );
    Convert_in_%_value ( );
    Read_humidity_&_Temperature ( )
    Convert_into_RH ( );
    Convert_into_degreeC ( );
    Connect_to_web_server ( );
    If(Server _connected)
            Post_data_over_server ( );
        Else
            Through_error ( );
}
```

B. *Actuator Node:*

```
Setup ( )
{
    Initialize_wifi_component ( );      //Wi-Fi  Variables.
    Initialize_server_component ( );    // Server Variables.
    Initialize_global_component ( );    //Rest Variables.
    Initialize_digital_pins ( );        //Digital i/o Pins
    While(Wifi_Not_Connected)           // Wait till the wifi gets connected
    {  Connect_to_wifi_host ( ); }
    While(Server _not_connected)        //Wait till device connected to server.
    { Connect_to_server_host ( ); }

}
Loop ( )
{
    read_all_sensor_node_data  ( );
    Read_light_intensity ( );
    If(is _manual_control)
    {
        Check_device_status ( );
        If(is_light_on)
            Turnonlight ( );
        Else
            Turnofflight ( );
        If(is_pump_on)
            Turnonpump ( );
        Else
            Turnoffpump ( );
        If(is_steam_on)
            Turnonsteam ( );
        Else
```

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```
                Turnoffsteam ( );
        If(is_fertilizer_on)
                Turnonfertilizeron ( );
        Else
                Turnofffertilizeroff ( );
        If(is_freshair_on)
                Turnonfreshair ( );
        Else
                Turnonfreshairo ( );
        If(is_heater_on)
                TurnonHeater ( );
        Else
                TurnoffHeater ( );
    If(is_cooler_on)
        TurnonCooler ( );
    Else
        TurnoffCooler ( );
    }
    Else
    {
    Convert_in_%_value ( );
    Read_humidity_&_Temperature ( )
    Convert_into_RH ( );
    Convert_into_degreeC ( );
    Connect_to_web_server ( );
        If(is_humidity_low)
                turnonStem ( );
        else
                turnoffSteam ( );

        If(is_temperature_low)
        {
                turnonHeater ( );
                turnoffCooler ( );
        }
        Elseif(is_temperature_high)
        {
                turnoffHeater ( );
                turnonCooler ( );
        }
        Else
        {
                turnoffHeater ( );
                turnoffCooler ( );
        }
        If(is_moisture_low)
                turnonPump ( );
        Else
                turnoffPump ( );
        If(is_light_low && is_day_time);
                turnonLight ( );
        else
                turnoffLight ( );
        }
    }
}
```

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IV. DATABASE STRUCTURE AND WEB APPLICATION

A database is a structured collection of information / data that exists over a period of time. It is the collection of tables, queries, schemas, views, reports and etc. The data / information is typically structured to model aspects of use of data in real world, such as modeling the availability of seats in flight in a way that supports finding a flight with vacancies. Software applications that are designed especially for capture and analyze data, this software program is known as database management system (DBMS).

A. ***tblusermaster*** – To store user specific information.

Name of Table		tblusermaster			
Name	**Data Type**	**Null**	**Default Value**	**Extra**	**Remark**
userid	int(64)	Not Null	None	Auto increment	Primary Key
fullname	varchar(64)	Not Null	None		
emailid	varchar(64)	Not Null	None		Primary Key
password	varchar(64)	Not Null	None		
usertype	int(64)	Not Null	None		
isactive	int(64)	Yes	NULL		

Table 1 tblusermaster structure

B. ***tblcontrollervalue*** – To store hardware system control information

Name of Table		tblcontrollervalue			
Name	**Data Type**	**Null**	**Default Value**	**Extra**	**Remark**
nodeid	int(64)	Not Null	None	Auto increment	Primary Key
nodename	varchar(64)	Not Null	None		
nodeusername	varchar(64)	Not Null	None		
nodeuseremailid	varchar(64)	Not Null	None		Foreign Key
corpname	varchar(64)	Not Null	None		
tempMin	varchar(64)	Not Null	None		
tempMax	varchar(64)	Not Null	None		
rhlimit	varchar(64)	Not Null	None		
moisturelimit	varchar(64)	Not Null	None		
ismanualcontrol	int(64)	Not Null	0		
devicePump	int(64)	Not Null	0		
deviceHotAir	int(64)	Not Null	0		
deviceCoolAir	int(64)	Not Null	0		
deviceLight	int(64)	Not Null	0		
deviceFertilizer	int(64)	Not Null	0		
deviceFreshAir	int(11)	Not Null	0		
isstatuschanged	int(64)	Not Null	0		

Table 2 tblcontrollervalue structure

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C. ***tbldatavalue*** – To store sensed data received from sensor node.

Name of Table		tbldatavalue			
Name	**Data Type**	**Null**	**Default Value**	**Extra**	**Remark**
id	int(64)	Not Null	None	Auto increment	Primary Key
emailid	varchar(64)	Not Null	None		Foreign Key
nodeid	varchar(64)	Not Null	0		Foreign Key
temp	varchar(64)	Not Null	0		
RH	varchar(64)	Not Null	0		
moisture	varchar(64)	Not Null	0		

Table 3 tbldatavalue structure

V. WEB APPLICATION

The major parts of web application the User level information in admin user panel, view/edit/update option, and report panel which complete the entire software solution. Let us first discuss the user profile manager panel shown in figure 3 in this the system is divided in 3 parts in first part user can view his own information accessible to all users, part 2 can be used by Admin user to create new user, and part 3 to delete any user if needed part 2 and part 3 both are visible to admin user only.

Figure 3 User profile manager

Now we discuss about view node specific information page show in figure 4 which is divided into 4 parts part 1 to view node specific information, part 2 is set and view controlled parameter inside the polyhouse, part 3 is specific to show current environmental parameters, and part 3 is used for manually controlling the devices connected to it all parts of this page is accessible to all users only government and admin user can change the predefined parameters in part 2 rest all options are available to all users.

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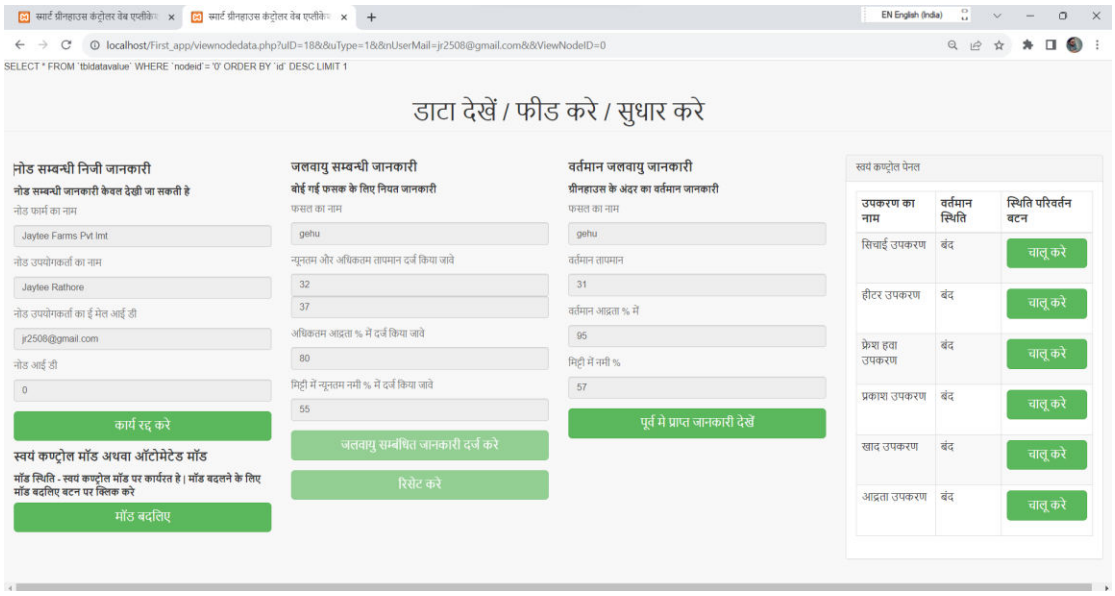

Figure 4 View node specific information

The last option of the web application is shown in figure 5 this page shows the reports as per required by the user either user can view graphical report and in listed form too.

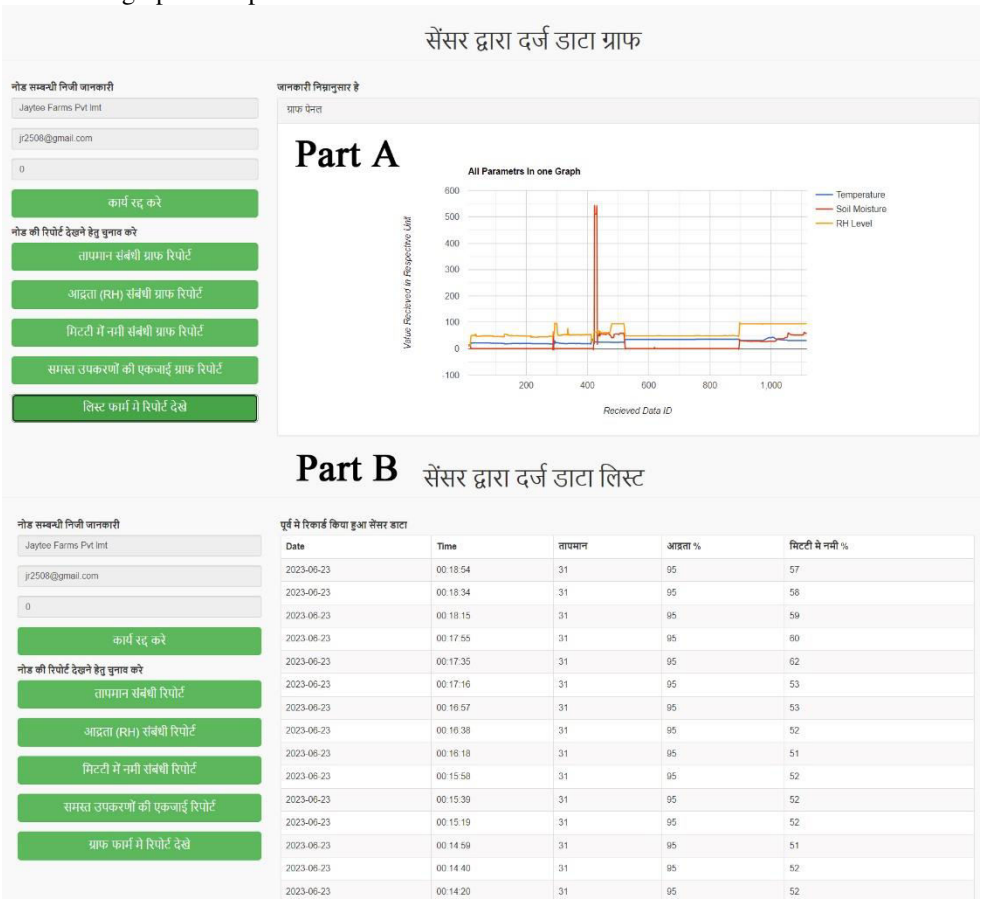

Figure 5 Report view page

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VI. CONCLUSION

The low-cost greenhouse / poly house monitoring and controlling web application is discussed here in this paper. The software is developed in "Hindi" language and easy to understand and has control devices connected to server. The last report view can be used by government user to make policies or change parameters according to environmental conditions of any specific geographical condition.

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