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Renesis based Smart Irrigation

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Abstract: *This paper proposes a smart technique for measurement of three parameters essential for Irrigation that includes Humidity, Temperature and Moisture by interfacing with suitable sensors. The measured parameters are dynamically updated to the on-line remote server at the regular intervals of time automatically. This dynamic data can be accessed by the farmer at any instant of time for switching ON and OFF of the IP enabled Water Pump and water supply chain. The system also incorporates unique Individual IP address for every sensor. To make it a generic system the data is fetched with a simple internet connection over the mobility device. The entire system is developed on the smart platform of InternetOf Things (IoT) with suitable Interfacing of embedded system.*

Keywords: Sensors, Embedded System, IoT, Smart Irrigation

I. INTRODUCTION

Agriculture continues to bethe backbone of developing economies including India for its vital role in providing food, feed, fibre, fuel and livelihood for the world's 800 million peoplewho suffer from hunger and poverty. Of the many strategies that have proposed and developed to addressthe issues of global poverty and environmental degradation, embedded system technology is seen as a viable contribution to the solution. Climate-smart agriculture includes practices and technologies that sustainably increase productivity, support farmers adaptation to climate change, and reduce levels of greenhouse gases. It can also help governments to achieve national food security and poverty reduction goals. Climate-smart approaches can include many diverse components from farm-level techniques to international policy and finance mechanisms[1].

II. PROBLEM STATEMENT

Farmers are facing major problems in monitoring the condition of soil in the farm field and as an serious issue, Database management and tabulation of the moisture content, temperature & humidity condition of soil plays an important role in the switching ON/OFF of the water pump as it dependent on the unscheduled load shedding from electricity department. The Other factor is yield of crop that is directly related to the sustainability of crop to the dynamic weather conditions that results in the drastic changes in temperature, moisture & humidity of soil which isa major substrate the crop yielding[2].

Thus our major principle objective is to develp an novel technique for the IP based smart irrigation system to overcome the problems faced by the Indian farmers for the essential parameters of the farm land. The system interfaces the available sensors to Reneses and raspberry pi embedded system devices.

The rest of the paper is as organized Section III deals with block diagram of proposed system ,Section IV presensts the methodology and Section V deals with Results and Discussion followed by Conclusion in Section VI.

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III. BLOCK DIAGRAM

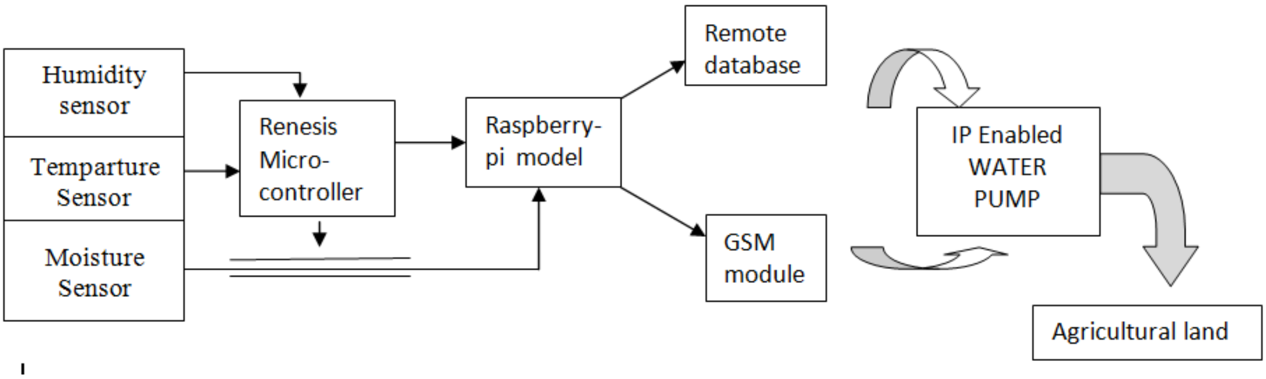

Fig 1. Block diagram of the proposed system

The proposed method as shown in Fig 1incorporates the smart way of monitoring the various parameters of the soil conditions in the farm land. The hourly data of the particular piece of land that is under monitor is stored in the remote database i.e Amazon Account (on-line) from which the farmer (user) can get the data at any time and at any instant from his mobile phone just by sending an prescribed format of message.

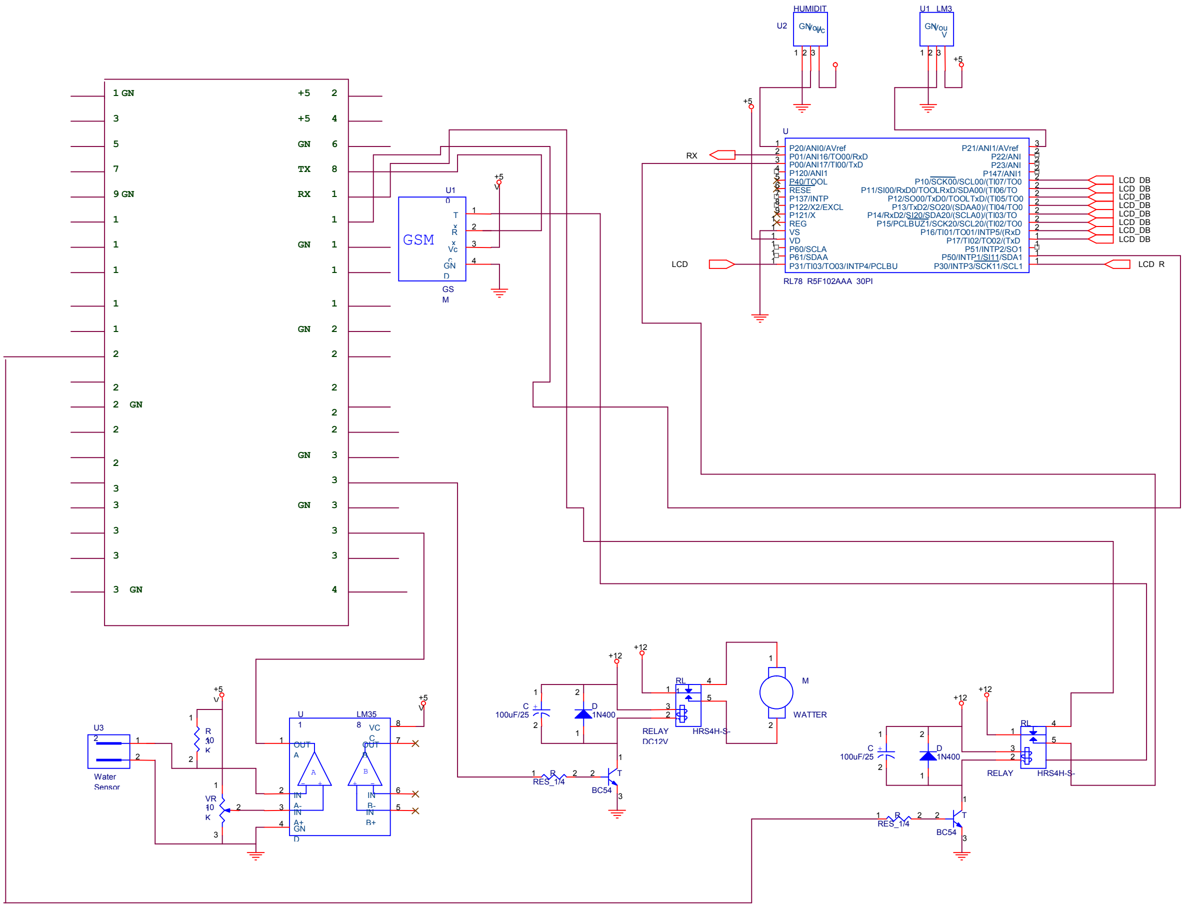

Fig 2. Schematic of proposed system.

Each & every set of analog data measured by the installed sensor is digitized using renesis microcontroller which acts as an analog to digital converter. The reason for using renesisas an aid for A/D converter because of its degree of accuracy, reliability, highest precision & reduced complexity in data handling.[3]

The digitized output is then fed as the Inputto the backbone of our entire system i.e. Raspberry PIthat is responsible for the allocation of unique IP address & interaction with the remote online server acting as an database for database

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management system of the farmer data.The raspberry-pi in the proposed systemis preferred due to its less design cost, user friendly programming style, available I/O pins, supporting of USB port & other essential user interface ports for accessibility.

Further this raw data has to stored in the amazon account& should be carefully monitored for controlling the water pump for balancing the measured data from the sensors. And also in this system, an GSM module is interfaced for implementing "Request & Replay" system by user at any instant of time[4].

To carryout Experiment, the temperature of 40^0 C & Humidity value of 75% was fixed. The presence or absence of moisture is indicated using the logic symbols.

The schematic diagram with logical connections is as shown in Fig 2. All the above indicated ranges can vary as per the user needs depending upon the different conditions of soil &wealth corresponding w.r.t. certain geographical areas. As we are concentrating on Indian farmers the suitable sensor are used with the same embedded system setup. The suitable sensors can be used with tuning depending on geographical conditions[5].

IV. METHODOLOGY

The predefined system device comprises of moisture sensor, temperature sensor(LM35),humidity sensor(HR202L), Renesas microcontroller, Raspberry PI and GSM/GPRS SIM900A modem[6]. Fig 3 shows the flow chart of proposed system.

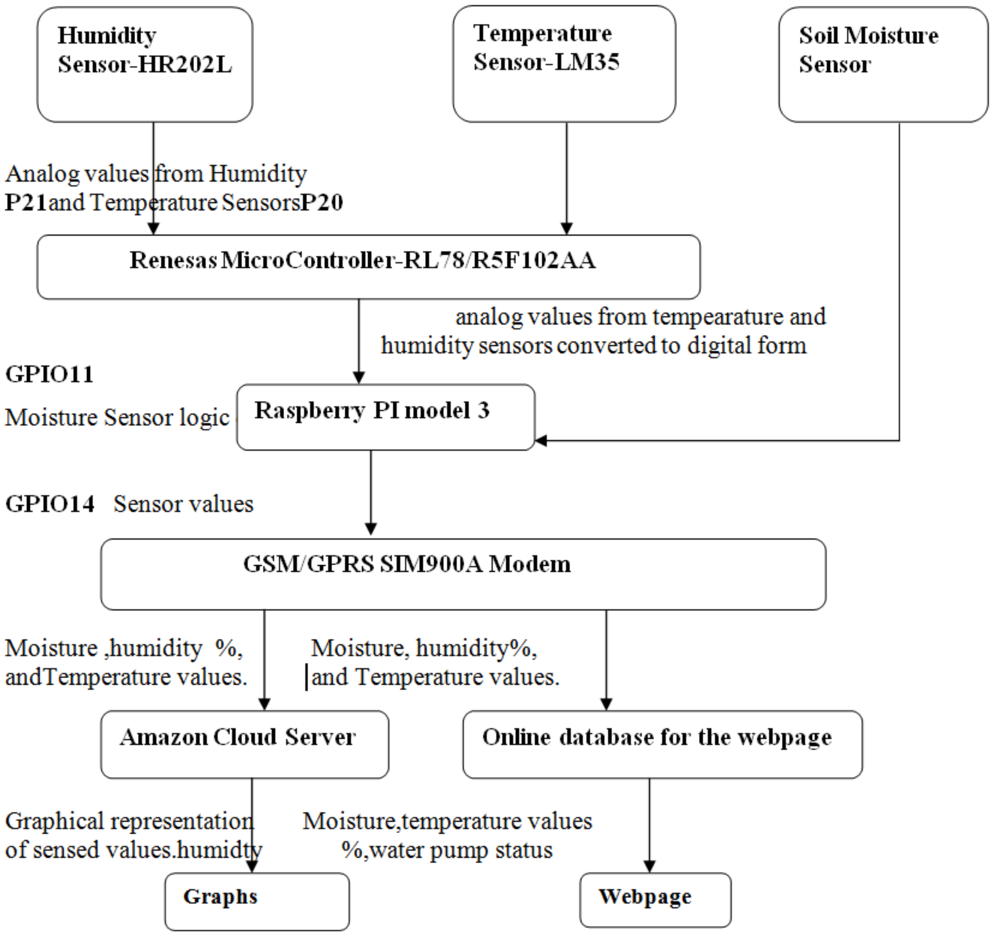

Fig 3.flow chart of proposed system

In this proposed system ,the output of the temperature sensor linearly proportional to temperature measured in celsius ,for every degree variation there will be 0.01V varition, humidity sensor will detect presence of water in air by placing a thin strip of metal oxide between two electrode sis used.

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These acquired analog values from temperature sensor and humditiy sensors are converted to digital form using renesas microcontroller which has inbuilt 10bit resolution ADC using succesive apporximation method. The data from moisture sensor which is in logic value will be directly given to Raspberry Pi, also the digitized data from renesas is also given to the Raspberry PI for further processing. The GSM modem is primary responsible for transmitting the data obtained from Raspberry PI to internet[7]. This is done using AT commands.

The information from sensors is transmitted to an online database from where it is used to display on a website. The webpage displays the moisture content in soil which has been divided into two categories, Low and High along with temperature and humidity contents[8].Water Pump operation depends the moisture content and threshold values of temperature and humidtiy. The threshold values depend on the type of soil used.

Readings from the three sensors were also transmitted to a Amazon web server channel to obtain graphs. Amazon web server is an open data platform and API for the Internet of Things that enables us to collect, store, analyze, visualize, and act on data from sensors or actuators, such as Raspberry PI.

Controlling the operation of Water Pump is done based on decision tree which is shown in Fig 4.

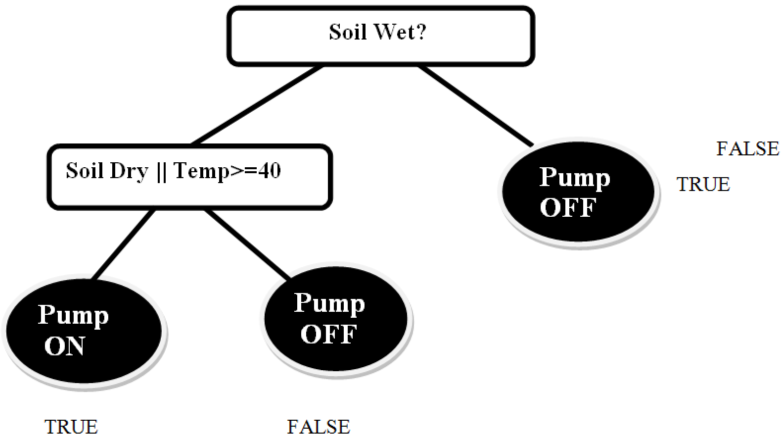

Fig.4Decision tree for Controlling the Operation of Water Pump

Farmer can check the status of the farm and switch On water pump manually using website and also depending upon the soil condition & water level, water pump motor is turned on or off automatically. Thus the status of the entire farm can be monitored & updated remotely with help of Internet of Things .

V. RESULTS AND DISCUSSION

A smart irrigation system based on IOT was designed and developed using renesas and raspberry PI embedded system. The prototype developed was tested in a potato farm in Budikote near kolar district. Testing involved checking the moisture content in the soil which enables the system to switch the water pump ON or OFF and also monitoring temperature, humidity values.

The readings were taken over a period of one hour and it is diplayed in the website as shown in Fig 5 to observe the variations in the sensed values. based on the readings taken analysis can be done using graphs.Fig6 and Fig 7 shows the analysis graphs of temperature and humidity plotted over a period of ten minutes .

By oberving the graphs farmer can Switch On or Switch Off water Pump manually.

With this technology a farmer can remotely monitor the irrigation process on the farm. Hence, the system is contributed in making a smart farm.

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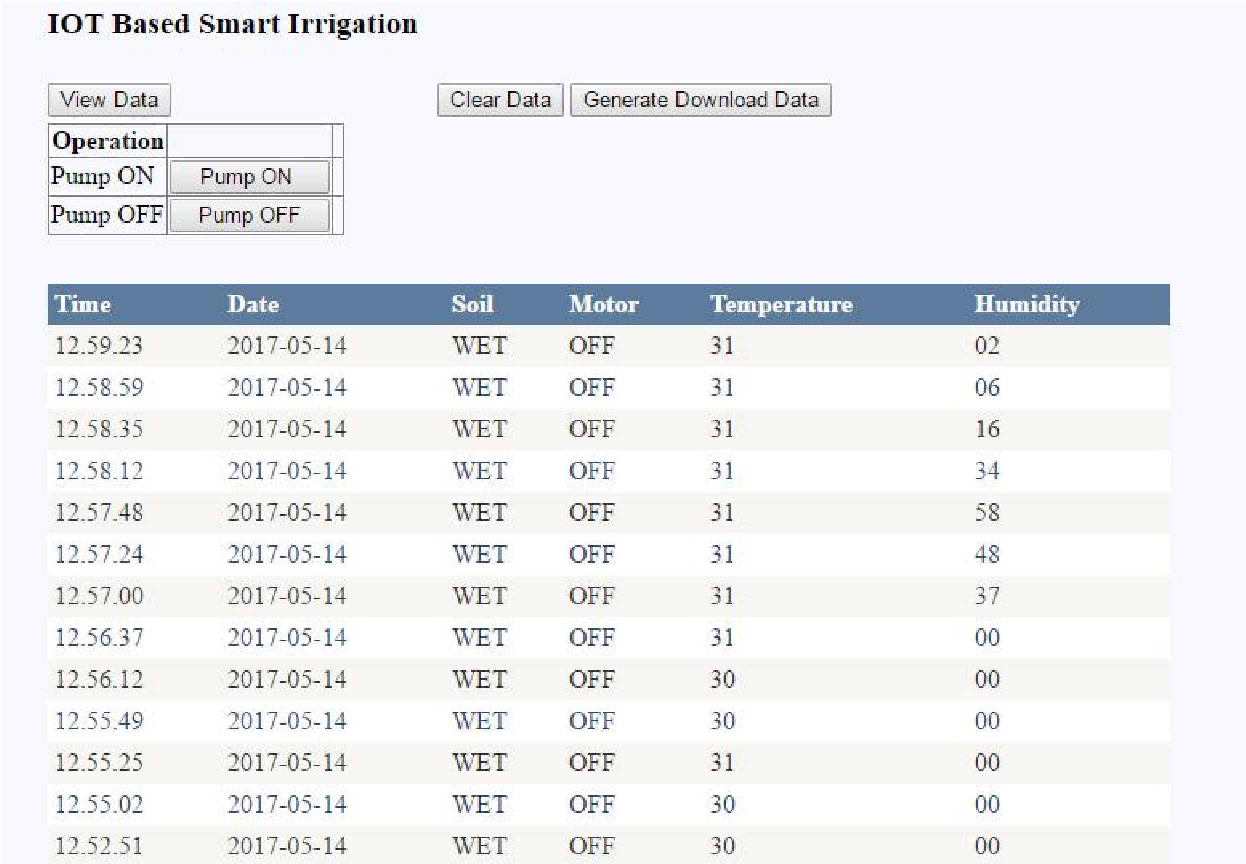

IOT Based Smart Irrigation

View Data | Clear Data | Generate Download Data

Operation	
Pump ON	Pump ON
Pump OFF	Pump OFF

Time	Date	Soil	Motor	Temperature	Humidity
12.59.23	2017-05-14	WET	OFF	31	02
12.58.59	2017-05-14	WET	OFF	31	06
12.58.35	2017-05-14	WET	OFF	31	16
12.58.12	2017-05-14	WET	OFF	31	34
12.57.48	2017-05-14	WET	OFF	31	58
12.57.24	2017-05-14	WET	OFF	31	48
12.57.00	2017-05-14	WET	OFF	31	37
12.56.37	2017-05-14	WET	OFF	31	00
12.56.12	2017-05-14	WET	OFF	30	00
12.55.49	2017-05-14	WET	OFF	30	00
12.55.25	2017-05-14	WET	OFF	31	00
12.55.02	2017-05-14	WET	OFF	30	00
12.52.51	2017-05-14	WET	OFF	30	00

Fig 5. Website view of farmer data.

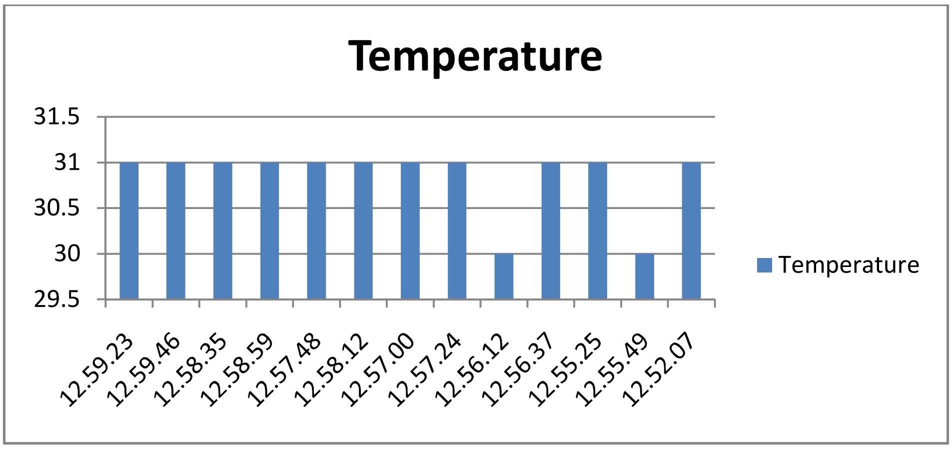

Fig 6.plotof temperature v/s time

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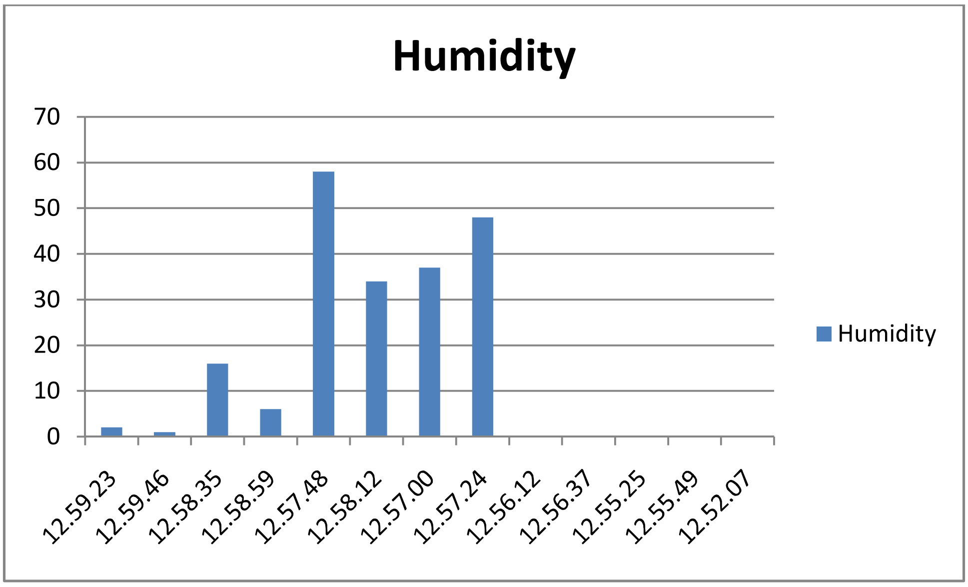

Fig 7.plot of Humidity v/s time

VI. CONCLUSION

This paper presents an innovative idea for smart Irrigation and a protoypeis also developed for the measurement of three essential parameters of farmer land i.e. Humidity, temperature& moisture using the available sensors namely HR206L, LM358&logical moisture sensor, by fixing the variable threshold for automatic ON/OFF of GSM/GPRS controlled water pump as an state of art. and also the remote database (Amazon Account) is monitored using internet. Using the modern technology IoT (Internet of things) , unique IP addresses are assigned for each & every sensor &to the microcontroller. At the outset we have achieved a novel solution for the major problems faced by Indian farmers in terms of Temperature, humidity& moisture contents of soil with the combination of embedded system techniques & technology.

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