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Automation System for Agricultural Management

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Abstract:

It is an automation system for checking the moisture content in the agricultural fields and watering them accordingly eliminating the manual effort. A soil moisture sensor is used to analyze the moisture content in the soil and it will update the information to the smart phone integrated with the sensor. The motor or sprinkler involved in watering the fields are turned on and off automatically through relays. The moisture content is monitored throughout the watering with the help of flow sensor and the humidity sensor is also used to monitor the humidity in the atmosphere of the fields. The watering is stopped when the crops reach an optimum level. This leads to conservation of water and ensures healthy crops. Nowadays, the farmers are suffering from lacking rain and water scarcity. The traditional farm land irrigation technique requires manual intervention. Whenever there is a change in humidity these sensors sense the change in humidity and gives an interrupt signal to the micro-controller. Thus water is supplied to the farm land in efficient and sufficient manner.

Keywords **— Bluetooth, humidity, sensor, ATMEGA-8, moisture.**

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I. INTRODUCTION

A sensor is a device that detects and response to some type of input from the physical environment. the input could be moisture pressured or any other environmental phenomena, the output could be any signal. A sensor's sensitivity indicates how much the sensor's output changes when the input being changed. Humidity sensor is used to check the presence of water in air. The presence of water vapor influences various physical, chemical and biological process. Humidity sensing is very important, especially in the control system for industrial processes and human comfort. In semiconductors industry, humidity or moisture level needs to be properly controlled and monitored during water processing. In medical application humidity control is required for respiratory equipment, sterilizers, incubators and all biological products. Humidity control is also necessary in chemical gas purification, dryers, ovens, paper and textile productions, and food processing. In agriculture humidity measurement is most important for dew preventions, soil moisture monitoring, etc. for domestic applications, humidity control is required for living environment in buildings etc. in all such applications and many others, humidity sensors are employed to provide an indication of moisture levels in the environment. The study of water vapor concentration in air as a function of temperature and pressure falls under the area of psychometrics. Humidity measurements determines the amount of water vapor present in the gas that can be in a mixture such as air or pure gas. Most commonly used units for humidity measurement are relative humidity[RH], dew point[DPT] and parts per million[ppm]. RH is a function of temperature, and it is a relative measurement dew point is a function of the pressure of the gas but is independent of temperature and absolute humidity measurement. Ppm is also an absolute measurement. Soil moisture sensor[SMS] measures soil moistures at the root zone and regulate the existing conventional irrigation timer, resulting is considerable water savings when installed and used properly. A customized soil

water content threshold is set, allowing for dryer or water soil condition. SMS functions similarly rain sensor by bypassing irrigation events under rainy condition, but by measuring soil moisture at the root zone they are more effective at minimizing irrigation when plants do not need additional water.

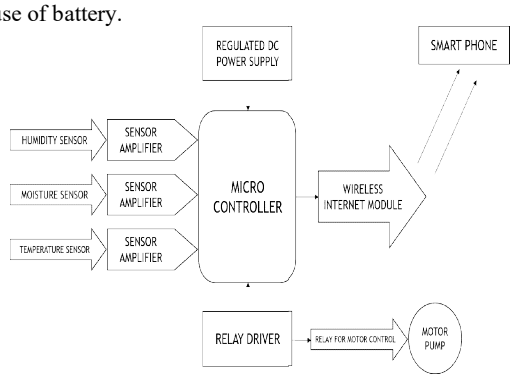
The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture portable probe instruments can be used by farmers. Soil moisture sensor estimates volumetric water content in the field of agriculture the soil sensors are used. Measuring soil moisture is important for agricultural application to help farmers manage their irrigation systems more efficiently. Knowing the exact soil moisture condition on the fields, not only farmers able to use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages.

In the existing system, automated irrigation was designed and assembled which serves the reduce of water consumption and human monitoring time. This system is manufactured at relatively low cost using simple electronic parts but soil moisture probe is the most expensive component. This system is designed to serve home environment. Many improvements can be made to make the system more versatile, customizable and user friendly. There are some improvements can be done as follows:

1. The timing can be defined by the user instead of being hard wired in the logic circuit electronics.
2. Data logging and exporting may be offered.
3. The threshold humidity levels may be adjustable using several multi-turn potentiometers.
4. The use of several moisture probes may be allowed with the addition of multiplexing circuits.
5. All electronic components may be in corporate on a printed circuit board. They may be also integrated onto a single chip or system on chip.
6. Mass production of the controller will reduce the cost of components and assembly.
7. The system may be further extended for outdoor utilization.

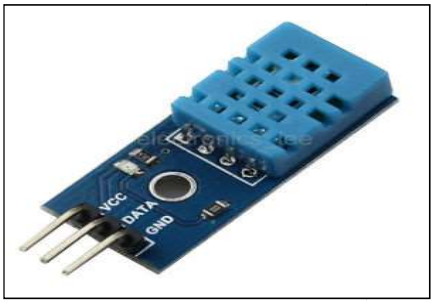
II. METHODOLOGY

The automatic irrigation system is designed to continuously sense the moisture level of the soil. The system responds appropriately by watering the soil with the exact required amount of water and then shuts down the water supply when the required level of soil moisture is achieved. An android application is designed to monitor the motor operations and we control the operations over the application. This application also indicates and informs the humidity levels of air on the farm and also the soil moisture level on the ground of crop farm. A wireless connectivity is made with the help of Bluetooth. Bluetooth connectivity is made for getting update information from various sensors and microcontroller. A wired connection is made between microcontroller and various sensors. A power supply is given through a battery. A DC motor used, which has given power supply with the use of battery.



III. SYSTEM DESIGN

A. *HUMIDITY SENSOR*



Humidity sensors work by detecting changes that alter electrical currents or temperature in the air. There are the basic types of humidity sensors: capacitive, resistive and thermal. All three types of sensors monitor minute changes in the atmosphere in order to calculate the humidity in the air.

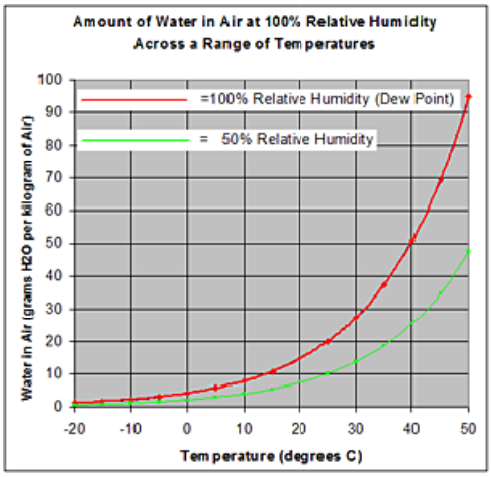
Absolute Humidity:

Absolutely humidity is the total mass of the water vapor present in a given volume of air. It does not take temperature into consideration. Absolute humidity in the atmosphere ranges from near zero to roughly 30 grams per cubic meter when the air is saturated at 30^0 c (86^0) F.

Absolute humidity in chemical engineering may refer to mass of water vapor per unit mass of dry air, also known as the mass mixing ratio, which is better suited for heat and mass balance calculations. Mass of water per unit volume. Units should always be carefully checked. Many humidity charts are given in g\kg or kg\kg, but any mass units may be used. The field concerned with the study of physical and thermodynamic properties of gas-vapor mixtures is named psychrometrics.

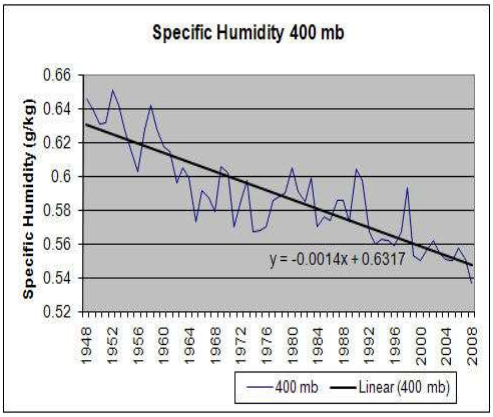
Relative Humidity:

The relative humidity (RH) of an air-water mixture is the ratio of the partial pressure of water vapor (H_2O) in the mixture to the equilibrium vapor pressure of water over a flat surface of pure water at a given temperature.



Relative humidity is an important metric used in weather forecasts and reports, as it is an indicator of precipitation, dew or fog. Relative humidity is normally expressed as a percentage means that the air-water mixture is more humid.

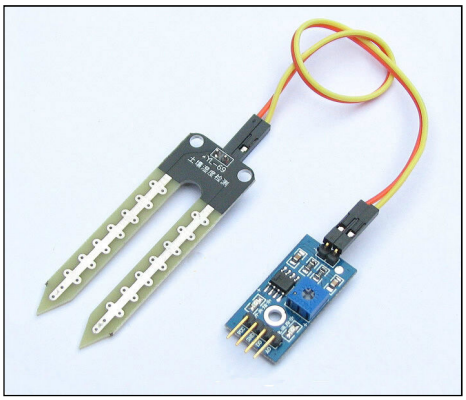
Specific humidity:



Specific humidity or moisture content is the ratio of the mass of water vapor to the total mass of the moist air parcel. Specific humidity is approximately

equal to the "mixing ratio", which is defined as the ratio of the mass of water vapor in an air parcel to the mass of dry air for the same parcel. As temperature decreases, the amount of water vapor needed to reach saturation also decreases. As temperature of a parcel of air becomes lower it will eventually reach the point of saturation without adding or losing water mass. The differences in the amount of water vapor in a parcel of air can be quite large.

B. SOIL MOISTURE SENSOR (SMS)



The SMS is used to measure the volumetric water content of soil. This makes it ideal for performing experience in courses such as soil science, environmental science, horticulture, botany and biology.

Positioning the sensor:

The prongs should be oriented horizontally, but rotated on to their side-like a knife poised to cut food –so that water does not pool on the flat surface of the prongs. The horizontal orientation of the sensor ensures the measurement is made at a particular soil depth.

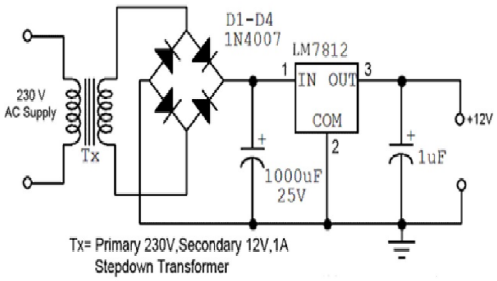
Removing the sensor:

When removing the sensor from the soil, do not pull it out of the soil by the cable. Doing so may break internal connections and make the sensor unusable.

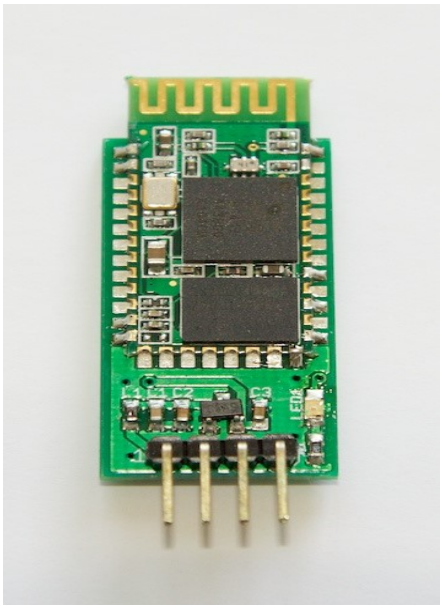
C. MICRO CONTROLLER – Atmega8

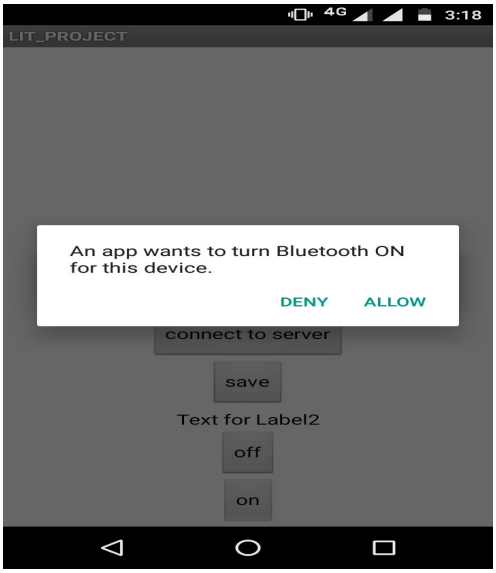
A monitoring and protection circuit for 1-cell and 2-cell Li-Ion applications that require high security and authentication, accurate monitoring, low cost and high utilization of the cell energy. The microcontroller includes 8KB self-programming flash memory, 512-bytes SRAM, 256-bytes EEPROM, 1 or 2 cells in series, 12-bit voltage A/D converter and debug wire interface for on-chip debug.

D. *POWER SUPPLY UNIT*



E. *BLUETOOTH AND MOBILE APPLICATION*





HC-05 module is easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port bluetooth modules fully qualified bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps modulation with complete 2GHz radio transceiver and baseband. It uses CSR bluecore 04-external single chip bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hoping Feature).

An Android OS supported smart phone is used as a receiver to receive all the information updates from the sensors and microcontroller via bluetooth, which is connected through wireless connectivity.

IV. CONCLUSION

This paper is proposed to support aggressive water management for agricultural Land. Microcontroller in this system promises about increase in systems life reducing the power consumption which results in lower power consumption. This system is fully automated and can be extensibility used with the help of IOT and using GPRS. Our proposed system reduces the manual effort and the burden of farmers. The wastage of water can be minimized in the current situation of water scarcity. It is very important to save water and to enhance agriculture.

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