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WEB BASED SMART FIELD MONITORING AND WATER MANAGEMENT SYSTEM

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Abstract:
The new challenge for refining plant growth reducing cost rationalizes the development of an automated watering system that will reduce the consumption of water and decrease man power and intensive care overhead. To advance irrigation water consumption proficiency, diminish cost of irrigation water, this project conferred the design of wireless sensor network and Internet technology of farmland automatic irrigation control technique. Emphasis on an exploration of the routing conventions of sensor network nodes to realize the system hardware and software design, middleware, and applications such as mobile phone or wireless Personal Digital Assistance of internet of things, will set up a series of sensors intelligent system, thus boosting the complete automation system and monitoring levels. User use mobile phones or wireless network can easily observe soil moisture content through online monitoring and control to realize the irrigation automation. Application consequences show that system through the embedded control technology ample intelligent irrigation, improve the irrigation water consumption efficiency. Field watering system atomization is commonly low status, can well recognize water saving.An automated watering system was developed to enhance water consumption for farming yields. The system has a distributed wireless network of soil-moisture and temperature sensors placed in the root area of the plants. In total, a doorway unit handles sensor information, triggers actuators, and transmits data to a web application. Into a microcontroller-based gateway system a formula was programmed which has been developed with some onset values of soil parameter such as temperature and moisture to control water quantity. The system had a duplex communication link grounded on a cellular-Internet interface that allowed for data review and irrigation planning to be programmed through a web page. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited biologically isolated zones.

***Keywords**:GSM,Zigbee,Tem,.humARM7,,Raspberry-pi.*

Introduction:

India is an agricultural country and 70% of farmers and people depend on the farming. In India utmost of the irrigation methods are operated manually. These out-of-datepractices are substituted with automated practices. The existingoutmodedprocedures are like ditch irrigation, terraced irrigation, drip irrigation. The universal irrigation setup is characterized by

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increased demand for higher agricultural throughput, poor performance and diminishedobtainability of water for cultivation. These complications can be applicable for remedying if we usean automated system for irrigation.Due to increased population growth and about 60% of complete presented land is engaged in the agriculture that ingests 82 % of available renewed water, consequently amount of water intake increases day by day towards globalization. Hence it is having a challenge in front of each and every single nation to withstand the replacement food condition and reducing the farm aquatic depletion. The necessity of rainwater to the Earthisdepending on the soil stuff, plus the amount of water required is likewise hangingupon the yield which breeds in the soil. In the earlier days some of the prevailing organization functioning for reducing the water ingestion in the agronomic fields, but these existing systems has some limitations. In those existing systems, the watering is completely deprived of questioning the stuff of the soil and in line to which schemes relate non-uniform fluid to this particular soil, in which it outcomes in minus harvests. Furthermore, earlier organismsneeded social involvement and supplementary ingesting of interval and hence here we necessitate recent technologies to control this difficulty and to maintain superior irrigation system, we have proposed a technology called “Web centered automatic irrigation scheme by means Wireless Sensor Network and GSM”.There are many systems to achieve water savings in various crops, from basic ones to more scientificallyprogressive ones. For case, in one system plant water standing was monitored and irrigation organized supported cover temperature dispersal of the plant that was no heritable with thermal imaging. In addition, further systems have been developed to program irrigation of yields and optimize water use by means of a crop water stress index. This index was later calculated using measurements of infrared canopy temperatures, ambient air temperatures, and atmospheric vapor pressure deficit values to determine when to irrigate broccoli using drip irrigation. Field watering systems can also be automated by usingthe information regarding water content of the soil that uses dielectric moisture sensors to control actuators and save water, instead of a preset irrigation schedule at a selected time of the day and with a selected length. The development of Wireless sensor networks are based on microcontrollers and communication technologies can improve the current methods of observation to upkeep the response aptly in real time for a wide choice of applications, considering the necessities of the deployed area, such as land-dwelling, underground, submerged, multimedia, and mobile.

Literature Survey:

After 25-30 years there might be a majorconcern for food because of India’s rapid population growth. Consequently, the development of agriculture is imperative. These days, the agrarians’zone is completelyscarce of rains and inadequacy of water. The prime objective of this projectdevelopment is to develop an automatic watering system thus saving time, cash and power of the grower. The standard cultivated-land wateringpractices need manual involvement. With the machine-controlled expertise of watering, the manual involvement will be reduced.

Each and every time there is a variation in temperature, humidity; wetness of the surroundings, these sensors sense the variations and provides an interrupt signal to the Controller. Then it will be transferred to the Web-based technologyso that agriculturalist will monitor and control the irrigation from any far-flungsite.Cultivation is the worldwide prime livelihood of the humanbeing, 64% of the total existing land is occupied by the farming, and it ingests 85 % of available fresh water. This amount of water ingestionrises every year due to globalization and population growth. There is a challenge in front of all countries to withstand the fresh food necessities and reducing the land water intake. Irrigation is the practice of watering the soil. The requirement of water to the soil relies on soil properties like soil moisture and soil temperature. It furthermore relies on the harvest which breeds in the earth. From last decade, few prevailing systems are working for controlling the farm water intake, but these arrangements have some restrictions. In these systems, watering is done without exploring the soil properties, due to which these arrangements apply non-uniform water to the soil, which results in a smaller amountof yields.Also,systems needadditional human involvement and time-consuming. So there is a need for anup-to-date technology to mitigate this issue and aidimproved water controlling. For that, we have proposed a system which is Web-based automatic irrigation system using wireless sensor network and GSM. The wireless sensor network forms the networks of numerous devices having capable of computation, communication, and sensing. It presents a link between the actual physical world and virtual worlds and offers a variety ofprospective applications of Cultivation, home automation, science, civil infrastructure, and security. In this proposed system Wireless Sensor Network is consists of two sections, Transmitter/field section and a Receiver section. Each section primly includes memory, processor, and an RF transceiver. The Receiver section is based on Raspberry Pi embedded Linux board. The working of the Receiver section in the system is to start the communication with distributed End devices i.e. transmitter section via the ZigBee wireless communication protocol and uninterruptedlygathers the soil moisture and soil temperature data and displays. Receiver section studies the received data and resolves thewater need for the soil. If the studied data indicates that water is essential, the receiver section sends commands to water pump controller make Irrigation ON. Raspberry Pi has an Ethernet interface and it runs a simple data web server. Therefore, Receiver section allows data collection over ZigBee, and data monitoring and system control from web browser remotely at the same time sends message alert to the farmer for every function of motor and soil conditions through GSM technology.

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Proposed System:

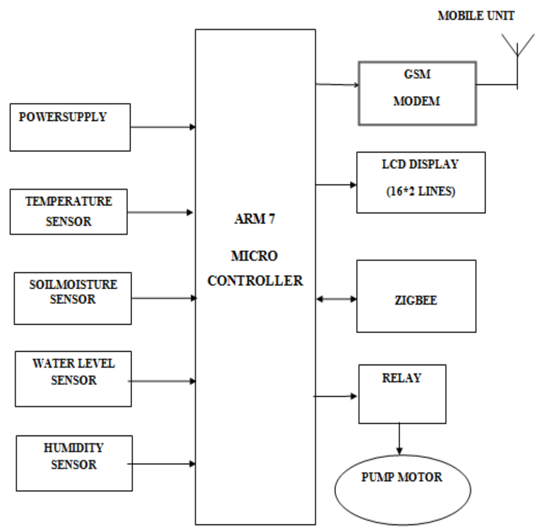

Fig: 1:Block diagram Transmitter section

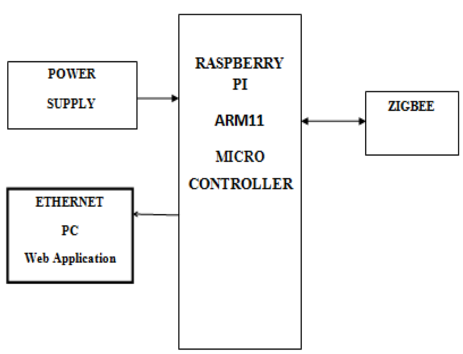

Fig: 2: Block diagramReceiver section

Methodology:

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

Raspberry Pi : The Raspberry Pi delivers 6 times the processing capacity of previous models. This second generation Raspberry Pi has an upgraded Broadcom BCM2836 processor, which is a powerful ARM Cortex-A7 based quad-core processor that runs at 900MHz. The board also features an increase in memory capacity to 1Gbyte.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

GSM:

Global System for Mobile Communication (GSM) is a set of ETSI standards specifying the infrastructure for a digital cellular service.The network is structured into a number of discrete sections.Base Station Subsystem – the base stations and their controllers explained.Network and Switching Subsystem – the part of the network most similar to a fixed network, sometimes just called the "core network" GPRS Core Network – the optional part which allows packet-based Internet connectionsnetwork maintenance.SM was intended to be a secure wireless system. It has considered the user authentication using a pre-shared key and challenge-response, and over-the-air encryption. However, GSM is vulnerable

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to different class of attacks, each of them aiming a different part of the network.

Fig: 3: GSM Module

Temperature sensor:

A thermistor is a type of resistor whose resistance is dependent on temperature. Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically), self-resetting over current protectors, and self-regulating heating elements. The TMP103 is a digital output temperature sensor in a four-ball wafer chip-scale package (WCSP). The TMP103 is capable of reading temperatures to a resolution of 1°C.

Fig: 4: Temperature sensor

Soil moisture sensor:

Functional description of Soil moisture sensor: The two copper leads act as the sensor probes. They are immersed into the specimen soil whose moisture content is under test. The soil is examined under three conditions:

STEP1: Dry condition- The probes are placed in the soil under dry conditions and are inserted up to a fair depth of the soil. As there is no conduction path between the two copper leads the sensor circuit remains open. The voltage output of the emitter in this case ranges from 0 to 0.5V.

STEP2: Optimum condition- When water is added to the soil, it percolates through the successive layers of it and spreads across the layers of soil due to capillary force. This water increases the moisture content of the soil. This leads to an increase in its conductivity which forms a conductive path between the two sensor probes leading to a close path for the current flowing from the supply to the transistor through the sensor probes. The voltage output of the circuit taken at the emitter of the transistor in the optimum case ranges from 1.9 to 3.4V approximately.

STEP3: Excess water condition- With the increase in water content beyond the optimum level, the conductivity of the soil increases drastically and a steady conduction path is established between the two sensor leads and the voltage output from the sensor increases no further beyond a certain limit. The maximum possible value for it is not more than 4.2V

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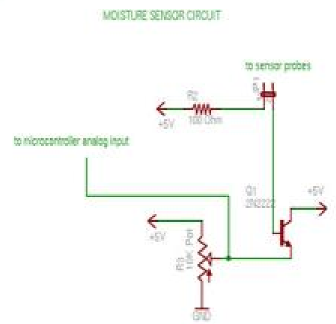

Fig: 5: soil sensor

Humidity sensor:

Humidity sensor is a device that measures the relative humidity of in a given area. A humidity sensor can be used in both indoors and outdoors. Humidity sensors are available in both analog and digital forms. An analog humidity sensor gauges the humidity of the air relatively using a capacitor-based system. The sensor is made out of a film usually made of either glass or ceramics. The insulator material which absorbs the water is made out of a polymer which takes in and releases water based on the relative humidity of the given area. This changes the level of charge in the capacitor of the on board electrical circuit. A digital humidity sensor works via two micro sensors that are calibrated to the relative humidity of the given area. These are then converted into the digital format via an analog to digital conversion process which is done by a chip located in the same circuit. A machine made electrode based system made out of polymer is what makes up the capacitance for the sensor. This protects the sensor from user front panel (interface).

Fig: 6:Humidity sensor

Water level sensor:

The sensor used for measurement of fluid levels is called a level sensor. The sensing probe element consists of a special wire cable which is capable of accurately sensing the surface level of nearly any fluid, including water, saltwater, and oils. The sensor element is electrically insulated and isolated from the liquid into which it is inserted, and will not corrode over time. Unlike, other sensors, the measurement range is adjustable from a few centimeters to over several meters. A variety of sensors are available for point level detection of solids. These include vibrating, rotating paddle, mechanical (diaphragm), microwave (radar), capacitance, optical, pulsed-ultrasonic and ultrasonic level sensors.

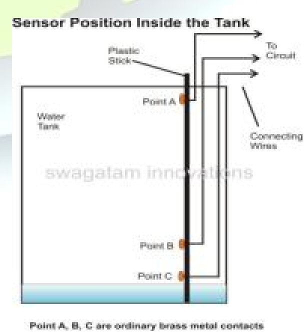

Fig: 7: Water level sensor

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DC Motor:

A DC motor relies on the fact that like magnet poles repels and unlike magnetic poles attracts each other. A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnetic field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°.

Fig: 8: DC Motor

Motor driver (L293D):

DC motors are typically controlled by using a transistor configuration called an "H-bridge". This consists of a minimum of four mechanical or solid-state switches, such as two NPN and two PNP transistors. One NPN and one PNP transistor are activated at a time. Both NPN and PNP transistors can be activated to cause a short across the motor terminals, which can be useful for slowing down the motor from the back EMF it creates. H-bridge. Sometimes called a "full bridge" the H-bridge is so named because it has four switching elements at the "corners" of the H and the motor forms the cross bar. The switches are turned on in pairs, either high left and lower right, or lower left and high right, but never both switches on the same "side" of the bridge. If both switches on one side of a bridge are turned on it creates a short circuit between the battery plus and battery minus terminals. If the bridge is sufficiently powerful it will absorb that load and your batteries will simply drain quickly. Usually however the switches in question melt.

Zigbee:

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this caseis ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The X-Bee RF Modules interface to a host device through a logic-level asynchronous Serial port. Through its serial port, the module can communicate with any logic and voltage Compatible UART; or through a level translator to any serial device. Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

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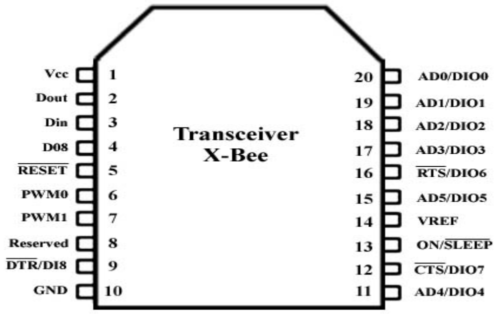

Fig: 9: ZIGBEE pin diagram

Ethernet:

Ethernet is a family of computer networking technologies for local area networks (LANs) and metropolitan area networks (MANs). It was commercially introduced in 1980 and first standardized in 1983 as IEEE 802.3, and has since been refined to support higher bit rates and longer link distances. Over time, Ethernet has largely replaced competing wired LAN technologies such as token ring, FDDI, and ARCNET. The primary alternative for contemporary LANs is not a wired standard, but instead a wireless LAN standardized as IEEE 802.11 and also known as Wi-Fi.

The Ethernet standards comprise several wiring and signaling variants of the OSI physical layer in use with Ethernet. The original 10BASE5 Ethernet uses coaxial cable as a shared medium, while the newer Ethernet variants use twisted pair and fiber optic links in conjunction with hubs or switches. Over the course of its history, Ethernet data transfer rates have been increased from the original 2.94 megabits per second (Mbit/s) to the latest 100 gigabits per second (Gbit/s), with 400 Gbit/s. Systems communicating over Ethernet divide a stream of data into shorter pieces called frames. Each frame contains source and destination addresses and error-checking data so that damaged data can be detected and re-transmitted. As per the OSI model, Ethernet provides services up to and including the data link layer.

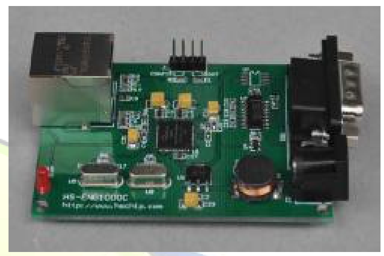

Fig: 10: Ethernet module

Result:

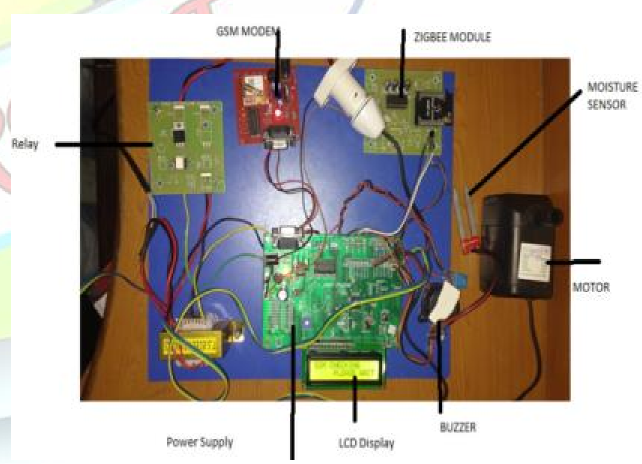

Fig: 11:Transmitter section

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Fig: 12: Receiver section

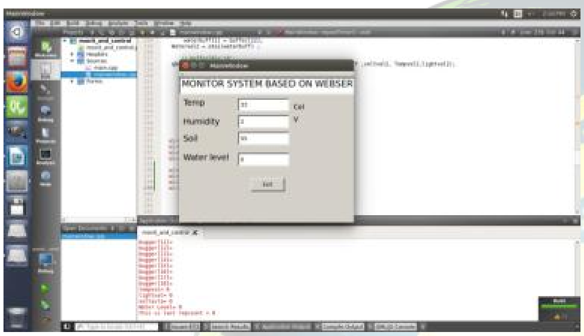

Fig: 13: Snap shot of Web page

Fig 14 Screen shot of Web application

Conclusion:

The project **"Web Based Smart Field Monitoring and Water Management System"** has been successfully designed and tested. I have developed my project byimplementing features of all the hardware components and software elements. Thereby using highly advanced ARM7 and Raspberry Pi with GSM with the help of growing technology the project has been successfully implemented. The automated field monitoring system implemented was found to be feasible and cost effective for optimizing water resources for agricultural production. This irrigation system consents cultivation in places with water scarcity thereby refining sustainability. The automated water management system developed proves that the use of water could be diminished for a specificvolume of fresh biomass production. The use of the advanced technology in this field monitoring system is pertinent and significantly important for organic crops and other agricultural products.

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