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IOT based Agriculture Monitoring System using Sensors

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***Abstract*—The Internet of things (IOT) is transformation the agriculture enabling the farmers with various techniques such as precision and sustainable agriculture to face challenges in the field. IOT technology is used to collect data about soil conditions, like weather, moisture, temperature and fertility of soil, Crop online monitoring enables detection of weed, level of water, pest detection, animal intrusion in to the field, crop growth, agriculture. The farm conditions are monitored by using wireless sensor networks and the farm processes can be automated by micro controller. To view remotely the conditions in the form of image and video, wireless cameras have been used. A smart phone empowers farmer to keep updated with the ongoing conditions of his agricultural land using IOT at any time and any part of the world. The cost can be reduced and enhance the productivity of traditional farming. Agriculture is the unquestionably the largest livelihood provider in India. With rising population, there is a need for increased for increasing agricultural production. So as to help more prominent creation in homesteads, the prerequisite of the measure of new water utilized in water system additionally rises. At present, agriculture accounts 83% of the total water Consumption in India. Spontaneous utilization of water incidentally results in wastage of water.**

***Index Terms*— component, formatting, style, styling, insert.**

I. Introduction

Internet of Things (IoT) are utilized for connecting physical objects, which have detecting networking and computing capabilities, to other objects and services over the Internet. The essential idea basic IoT isn't new, however IoT utilizes different numbers and sorts of gadgets and their system interconnection over the Internet. This prompts enormous changes in terms of integrations in the existing network; therefore, the IoT concept ensures that each device is accessible through the Internet.

In the last decade, technological changes have also affected farming yield creation and reproducing of household creatures. Using various sensors and wireless devices, farmers can get data about soil humidity and nutrient condition in the soil or the occurrence of plant diseases and pests in plants (Dang *et al*. 2013). On the basis of the information received, farmers can react in a timely manner and apply appropriate measures. Data on the operation of agricultural machinery is obtained using sensors, which enable operators to adjust machine operation to working conditions in order to achieve higher effectiveness and quality of the production process.

IoT brings a new production view to traditional agriculture, and it is oriented to the information network involving automation, use of intelligent devices and their networking in the process of agricultural production.

Benefits of IoT applications in agriculture include improvement in the use efficiency of inputs such as soil,

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water, fertilizers, pesticides, etc., reduced cost of production, increased profitability, sustainability, food safety, environmental protection (Patil *et al*. 2012). Through IoT, farmers are able to deliver their crops to customers on a wide scale. This can change the supply chain in the way to provide a more directed and shorter chain from the point of production to the consumer.

The idea of this work was to present the IoT concept in the monitoring and control system model applied to farm production processes. Moreover, the main focus is on definitions of IoT devices and their realizations by available microcontroller platforms, with shields and appropriate sensors, for example Arduino products.

II. System Design

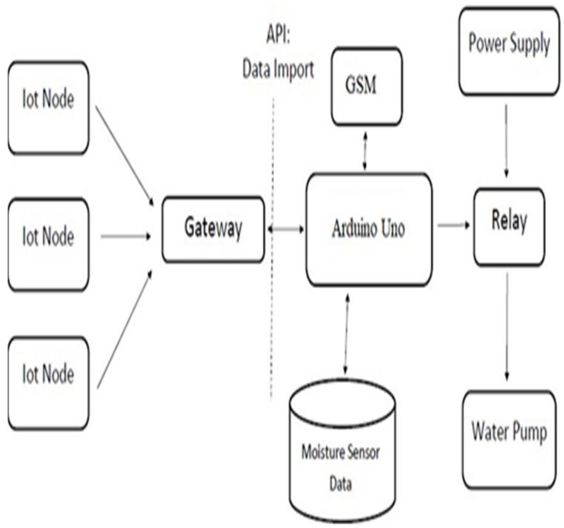

Fig.1 Soil moisture sensor

A. Arduino UNO

The Micro controller utilized here is an Arduino UNO. The UNO is a Microcontroller board dependent on ATMEGA 328P. The ATMEGA 328P has 32kB of flash memory for putting away code. The board has 14 computerized information and yield pins, 6 simple sources of info, 16 MHz quartz crystal, USB, an ICSP circuit and a reset catch. The UNO can be modified with the Arduino programming.

B. Soil Moisture Sensor

The moisture content present in the soil can be measured by Soil Moisture sensor. When the soil moisture value read by the sensor is over the limit esteem, low level (0V) will be the digital output and if it is over the limit esteem, high level (5V) will be the digital output. The digital pin is mainly for used for directly read current soil moisture value to see if it is above threshold or not.

C. DHT11 Sensor

Temperature and humidity of the soil can be measured by using DHT11. Capacitive humidity sensor and a thermistor are used to measure the surrounding air. This sensor is cost effective, provides low power consumption. It is possible to transmit the signal up-to 20 meter.

III. System Development

2G networks developed as a replacement for first generation (1G) analog cellular networks, and the GSM standard originally described a digital, circuit-switched network optimized for full duplex voice telephony. This expanded over time to include data communications, first by circuit-switched transport, then by packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution or EGPRS).

A. Network structure

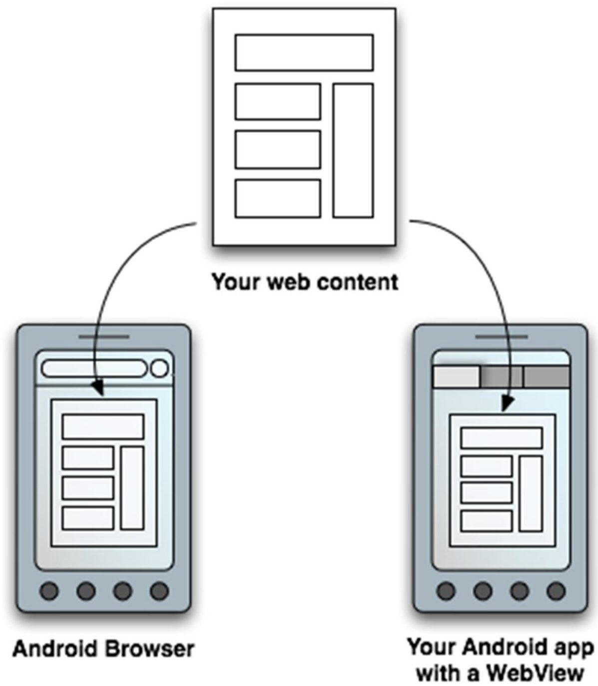

Figure2. You can make your web content available to users in two ways: in a traditional web browser and in an Android application, by including a WebView in the layout

GSM is a cellular network, which cell phones connect to it by searching for cells in the immediate vicinity. It contains five different cell sizes in a GSM network like macro, micro, pico, femto, and umbrella cells. The coverage area network of each cell may be varied based on their implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building over rooftop level. Micro cells antenna height is installed under average rooftop level; they are used in urban areas. Picocells coverage diameter is a few dozen metres; they are mainly used indoors. Femtocells are cells designed and mainly used in small business environments and connect to the service provider's network via a broadband internet connection. Umbrella cells are mainly used for covering shadowed regions of smaller cells and fill in gaps in coverage between those cells.

B. GSM carrier frequencies

GSM systems work in various distinctive carrier recurrence ranges (isolated into GSM recurrence ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM systems working in the 900 MHz or 1800 MHz groups. Where these bands were at that point dispensed, the 850 MHz and 1900 MHz bands were utilized rather (for instance in Canada and the United States). In uncommon cases the 400 and 450 MHz frequency bands are assigned in certain nations since they were recently utilized for original frameworks.
Most 3G arranges in Europe work in the 2100 MHz recurrence band. For more data on overall GSM recurrence use, see GSM recurrence groups.

C. Voice codes

GSM has used a different voice codes to squeeze 3.1 kHz audio into between 6.5 and 13 kbit/s. Originally, two codes were used, called Half Rate (6.5 kbit/s) and Full Rate (13 kbit/s). These used a system based on linear predictive coding (LPC).
In addition to being efficient with bitrates, these codecs also made it easier to identify more important parts of the audio, allowing the air interface layer to prioritize and better protect these parts of the signal.

D. Subscriber Identity Module (SIM)

Subscriber Identity Module is a one of the key features of GSM, commonly known as a SIM card. The SIM is a detachable smart card contains the customer's or client information and phone book. This allows the client to hold his or her data subsequent to exchanging handsets. Then again, the client can likewise change operator while holding the handset just by changing the SIM. Some operators will block this by allowing the phone to use only.

IV. EXPERIMENTAL DETAILS

To show the performance of BLA compared to remaining algorithms (GA, BA and MBO),the average rounded values of ten (10) best fitness obtained in each test for different algorithms are calculated and listed in Table 3. From Table 4.1 and Fig. 9, was mark that the best fitness is the fitness obtained by BLA (18,825.9687). It is better than other.

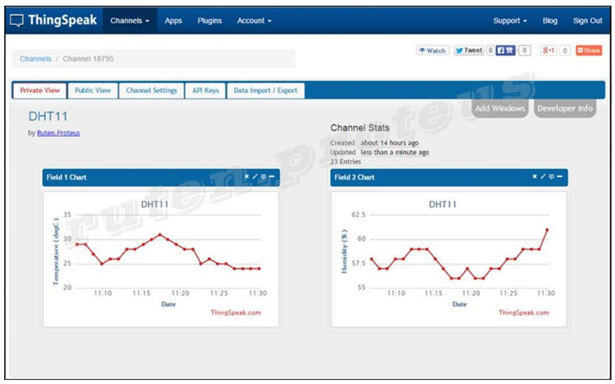

Fig.3 Shows Temperature and Humidity value relative to time

To compare the complexity of BLA in contrast to other approaches (GA, BA and MBO), we summarize time computing in Fig. 11 and Table 4. This figure illustrates the stagnation of the best solution fitness for each population with time consumed by each algorithm. One can note that BLA algorithm reached the best fitness (18,825.96) in the earliest generation (13th generation). This proved its low time complexity compared to the others approaches. For example, MBO algorithm reached its stagnation state at the 16th generation. We note also that the stagnation generation of BA algorithm is obtained at the 7th generation but with bad value (20,186.64). In this case, BA dropped in a local optima value in an early time. Moreover, GA stagnated in the 16th generation. This practical analysis showed that BLA converge to the optimal solution better than GA, BA or MBO with the least generation times. They confirm the reliability and efficiency of BLA to solve the QoS-MRP with a minimum time compared to other approaches. In fact, performances of BLA are due to the generalization of the proposed algorithm in terms of the optimization principles. It collects the global search using the crossover operator which guarantees the diversity of the solution. Also, it ensures the local optima escape. Furthermore, BLA carries out a local search in the mutation operator and also in the neighbor- hood search approach.

Fig.4 Shows soil moisture level analysed through Thing Speak

Fig.5 Shows the height of the plant (in cm) with respect to time

V. CONCLUSIONS

Internet of Things has enables the agriculture crop monitoring easy and efficient to enhance the productivity of the crop and hence profits for the farmer. Wireless sensor network and sensors of different types are used to collect the information of crop conditions and environmental changes and these information is transmitted through network to the farmer/devices that initiates corrective actions. Farmers are connected and aware of the conditions of the agricultural field at anytime and anywhere in the world. Some disadvantages in communication must be overcome by advancing the technology to consume less energy and also by making user interface ease of use.

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