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Intelligent Monitoring of Agriculture Environment for Production Enhancement using Alternate Energy Resources

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ABSTRACT: Multifunctional monitoring of Agricultural Environment for Social Modernization attracts great attention these days. Efficient water management is a major concern in many semi-arid and arid areas. More than two thirds of freshwater consumed in the worldwide are used for irrigation; large quantities of fresh water can be saved by using the efficient irrigation system. By means of using solar energy for automatic on/off of motor, it will reduce the power consumption. Since solar energy is sensitive to the environment; it requires no maintenance. And it is suitable for India which has high amount of annular solar irradiation rate. Fencing of fields is done by farmers to reduce unnoticed entry of animals or birds in the field. In order to modernize the whole agricultural environment, an image processing technique is adopted in this system to sense the images of animals or birds which are entering the field unexpectedly and give warning to them. The sensor values monitored by the controller can be sent to the user's cell phone using GSM modem. GSM is used to inform the user about the exact field condition. The information's is given on user request in form of SMS.

KEYWORDS: GSM module, PIC microcontroller, Solar Energy, Temperature sensor, Web camera, Image Processing

I. INTRODUCTION

Agriculture is the backbone of our country; it plays a vital role in the progress of Indian economy. The continuously increasing population in India demands for the rapid improvement in food production technology. The aim of farmer is to produce "more crop per drop", hence there is need to find the irrigation techniques which consumes less fresh water. Water is the main resource for agriculture. Hence efficient water management has a crucial importance. To save the water and to increase the yield of crop proper method of irrigation must be used. The primary aim of agriculture is to make the land more abundantly and at the same time to protect it from deterioration and misuse. As the generation evolved, man developed many methods of irrigation to supply water to the land. In the present scenario, the farmer has so many complications to maintain the field manually.

In recent years, energy sources has decreased gradually and increasing the demand for energy which makes the more efficient and positive use of alternate energy resources. In 19th Century, the production yield is 13.3 lakh tonnes. And now in 20th Century, it is gradually reduced to 5.3 lakh tonnes. To overcome this, we proposed an automatic irrigation system. Automatically scheduling irrigation events based on soil moisture measurements has been proven an effective means to reduce freshwater consumption and irrigation costs.

II. LITERATURE SURVEY

In some of the irrigation system irrigation scheduling is achieved by monitoring soil, water status with tension meters under drip irrigation by the automation controller system in sandy soil. It is very important for the farmer to maintain the content in the field. In this the design of a Micro-controller based drip irrigation mechanism is proposed, which is a real time feedback control system for monitoring and controlling all the activities of drip irrigation system more efficiently. Irrigation system controls valves by using automated controller allows the farmer to apply the right amount of water at the right time , regardless of the availability of the labor to turn valves[1]. Some irrigation systems

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are used to implement efficient irrigation scheme for the field having different crops. The system can be further enhanced by using fuzzy logic controller. The fuzzy logic scheme is used to increase the accuracy of the measured value and assists in decision making [2]. The green house based modern agriculture industries are the recent requirement in every part of agriculture in India. In this technology, the humidity and temperature of plants are precisely controlled. Due to the variable atmospheric conditions sometimes may vary from place to place in large farm house, which makes very difficult to maintain the uniformity at all the places in the farm house manually. For this GSM is used to report the detailed about irrigation. The report from the GSM is send through the android mobile [3]. The software and hardware combine together provide a very advanced control over the currently implemented manual system. The implementation involves use of internet for remote monitoring as well as control of Drip Irrigation system. This system uses sensors like humidity, soil moisture. These sensors send values to micro-controller. User can also control Drip Irrigation from anywhere via Android mobile [4]. In the Micro-controller based drip irrigation mechanism, this is a real time feedback control system for monitoring and controlling all the activities of drip irrigation system more efficiently. Irrigation system controls valves by using automated controller to turn ON/OFF. This allows the farmer to apply the right amount of water at the right time, regardless of the availability of the labour to turn valves or motor ON OFF. This reduces runoff over watering saturated soils avoid irrigating at the wrong time of the day. It improves crop performances and help in time saving in all the aspects [5]. The management of this kind of farms requires data acquisition in each green house and their transfer to a control unit which is usually located in a control room, separated from the production area. A solution based on a hybrid wired/wireless network, where Controller Area Network and ZigBee protocols are used. In particular, in order to integrate at the Data Link Layer the wireless section with the wired one, a suitable multi-protocol bridge has been implemented. Moreover, at the Application Layer, porting of Smart Distributed System services on ZigBee, called ZSDS, allows one to access the network resources independently from the network segment [6]. The some system highlights the development of temperature and soil moisture sensor that can be placed on suitable locations on field for monitoring of temperature and moisture of soil, the two parameters to which the crops are susceptible. The sensing system is based on a feedback control mechanism with a centralized control unit which regulates the flow of water on to the field in the real time based on the instantaneous temperature and moisture values [7]. Some system presents Artificial Neural Network (ANN) based intelligent control system for effective irrigation scheduling. The proposed Artificial Neural Network (ANN) based controller was prototyped using MATLAB. The input parameters like air temperature, soil moisture, radiations and humidity are modeled. Then using appropriate method, ecological conditions, Vapor transpiration and type of crop, the amount of water needed for irrigation was estimated and then associated results are simulated [8]

III. EXISTING WORK

Main reasons for the global water crisis – besides population growth, urbanization, and climate change – are excessive water use, poor management, and in adequate irrigation. According to the United Nations World Water Development Report, 70% of freshwater worldwide is used for irrigation. However, timer based systems possess several disadvantages because actual soil and weather conditions are not considered. Consequently, the amount of applied water does usually not match the requirements of the irrigated crop, and either too much or too little water is used for irrigation. Recent studies have unveiled that less than 40% of applied water is used by the irrigated crop effectively. Furthermore, it is well known that poorly managed irrigation systems not only contribute to water scarcity, but can also lead to significant soil damage caused by draining (due to water shortage) or leaching (due to excessive water application) entailing a further reduction in crop yield. To overcome the problems caused by inadequate and expensive irrigation, “smart” irrigation controllers have been proposed as an alternative to conventional timer-based irrigation controllers. Smart irrigation controllers, such as weather- or soil moisture-based devices, are able to automatically trigger irrigation events depending on actual site conditions. Soil moisture-based controllers, for example, trigger irrigation events based on the soil moisture content in the root zone of the crop. Many smart irrigation controllers lack the ability of automatically adjusting the irrigation run times, i.e. the quantity of applied water, based on real-time soil moisture measurements; rather, a preset quantity of water is applied for an irrigation event independently from the actual soil conditions. In consequence, even well designed and well-managed state of-the-art sprinkler irrigation systems achieve maximum irrigation application efficiencies between 20% and 75%. Apart from that, significant installation and maintenance costs due to wiring of the controllers arise, with at least US$ 130 per meter according to recent studies. With the advancements in wireless communications and microcontroller

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technologies, wireless sensor networks are deployed in agriculture to overcome the functional limitations and the high costs associated with conventional (cable-based) irrigation controllers.

IV. PROPOSED SYSTEM

The major objectives of the present work are,

- The supply to the overall circuit is given by solar energy
- The system supports water management decision, which determines the controlling time for the process and monitoring the whole system through GSM module
- The system continuously monitors the water level in the tank and provide accurate amount of water required to the plant or tree (crop).
- The system checks the temperature, humidity and dew point so as to forecast the weather condition.
- Low cost and effective with less power consumption using sensors for remote monitoring and controlling devices which are controlled via SMS using a GSM using android mobile.
- To avoid the crop damage by birds & animals, the field is continuously monitored.
- The image captured will be processed by the mat lab software.
- The processed output is interfaced with the controller.
- The controller updates the information to the farmer through GSM technology.

Automatic Irrigation System:

Automatic Irrigation system had been developed using Microcontroller, GSM, buzzer, relay, power supply unit and motor. When soil humidity value is less than the threshold value then the motor turn ON automatically but at that time water level in the tank is also checked. There are different conditions for the automation of the irrigation system depends on the sensor values. The block diagram for automatic irrigation system is given,

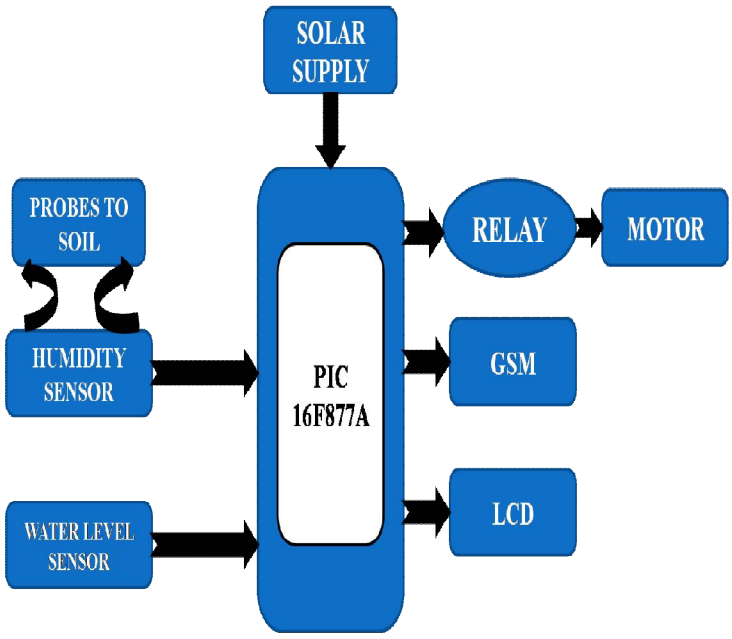

Figure 1: Block Diagram for automatic irrigation system

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Different set of operation for automatic irrigation system is given, based on the soil dryness and wetness. If the soil is dry, motor turns ON and vice-versa.

Condition	Soil Moisture	Water level	Motor Status
1	DRY	FULL	ON
2	WET	FULL	OFF
3	DRY	MEDIUM	ON
4	WET	MEDIUM	OFF
5	DRY	LOW	ON
6	WET	LOW	OFF
7	DRY	NULL	OFF
8	WET	NULL	OFF

Table1: Different conditions for irrigation system operation

Image processing Technique:
Here we set the monitoring area as a reference background for image subtraction. We shall be using web camera for real time video capturing of the monitoring area. These videos are splits in the form of frames to compare it with reference settled background. Computer or pc is the major part of the system. It is used here to collect the video captured by the web camera. After collecting the images from video, processing of that video in real time is done by the pc using the algorithm in MATLAB software. An image is an array or a matrix of square pixels (picture elements) arranged in columns and rows. Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from the image. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Figure 2 shows the block diagram for image processing technique.

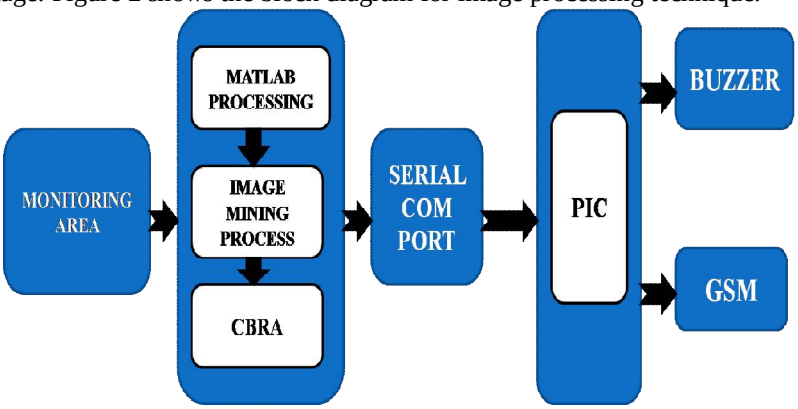

Figure 2: Block Diagram for Image processing Technique

A. Steps Involved In Image Mining Process Are

Step 1 : Read image from image database.
Step 2: Pre-process the image to improve the quality of the image. Preprocessing involves identification and labeling of the objects contained in the images using an image query processing algorithm. The output of the pre-processing step will be a set of records, one for each image, containing the object identifiers for the objects contained in the image. This step is quite intensive since it is a similarity search between images, actually image descriptors.
Step 3: Perform Transformation of images into database like table. In the table each row stands for a pixel. Thus the cardinality (no of rows) corresponds to the total number of pixels in an image. The columns correspond to the features associated with a pixel. These features can be local variation, grey level, entropy, contrast, mean, etc.

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Step 4: Once the database table has been obtained, perform feature extraction. Features characteristics of the objects of interest, if selected carefully, are representative of the maximum relevant information that the image has to offer for a complete characterization of the lesion.
Step 5: Once features have been extracted, perform mining using suitable data mining techniques to identify suitable patterns.
Step 6: Finally, the resulting patterns are evaluated and interpreted to obtain the final knowledge, which can be applied to applications.

After getting result from the image mining process to identify animal, the proposed algorithm is CBIR (Content Based Image Retrieval). The requirement for development of CBIR is enhanced due to tremendous growth in volume of images as well as the widespread application in multiple fields. Texture, color, shape and spatial layout are the underlying traits to represent and index the images. These peculiar features of images are extracted and implemented for a similarity check among images. The problem of content based image retrieval is based on generation of peculiar query. For relevant images that meet their information need, an automated search is initiated by drawing a sketch or with the submission of image having similar features. Similarity between extracted features can be measured by using different algorithms. The use of relevance feedback as a post retrieval step enhances the optimization of the process. The necessity to explore the ever growing volume of image and video is motivating the development of efficient CBIR algorithms.

The objective of this algorithm is to compute the dissimilarity between the two images represented in the form of two matrixes to generate the resultant matrix. Among the two input images, one image is the grey scale of the original image and the other image is the image obtained from the computation of the standard deviation of the input image. Then perform segmentation and extraction on the resultant image by the process of Thresholding.

The requirement for development of CBIR is enhanced due to tremendous growth in volume of images as well as the widespread application in multiple fields. Texture, color, shape and spatial layout are the underlying traits to represent and index the images. These peculiar features of images are extracted and implemented for a similarity check among images. The problem of content based image retrieval is based on generation of peculiar query. For relevant images that meet their information need, an automated search is initiated by drawing a sketch or with the submission of image having similar features. Similarity between extracted features can be measured by using CBIR algorithm.

Visual features as color, shape and texture are implemented for retrieval of images. Traditional methods of image indexing have been proven neither suitable nor efficient in terms of space and time so it triggered the development of the new technique. It is a 2 step process where image features are extracted in first step to a distinguishable extent. In second step matching of features which are visually similar is done. When the animal is detected the calculated result is given to the alert system via serial communication port.

B. ALGORITHM

Step 1: Start
Step 2: Image acquiring of monitoring area using web camera.
Step 3: Apply the image mining algorithm to identify change in setted reference background.
Step 4: If there is no change in the newly acquired image and setted reference go to step 2.
Step 5: Apply the CBIR algorithm to identify the animals.
Step 6: If the animal is not a desired animal which is harmful then go to step 2.
Step 7: Activate the alert system.
Step 8: Stop

V. RESULT

After the feasible results obtained by monitoring and controlling of farm; it is displayed in LCD display and the hardware kit has been developed and put it on the farm environment. The kit consists of a power supply unit, various sensors and the controller unit. The output from the sensors is continuously given to the controller. The complete layout of the circuit based on the alternate energy resources is given,

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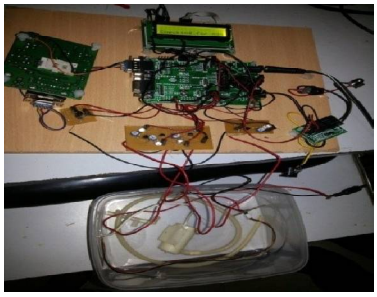
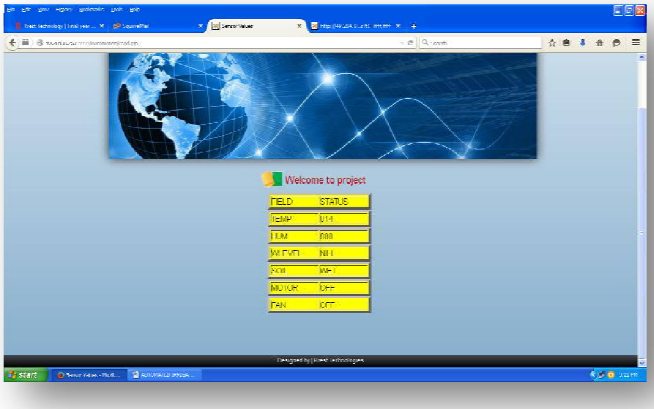
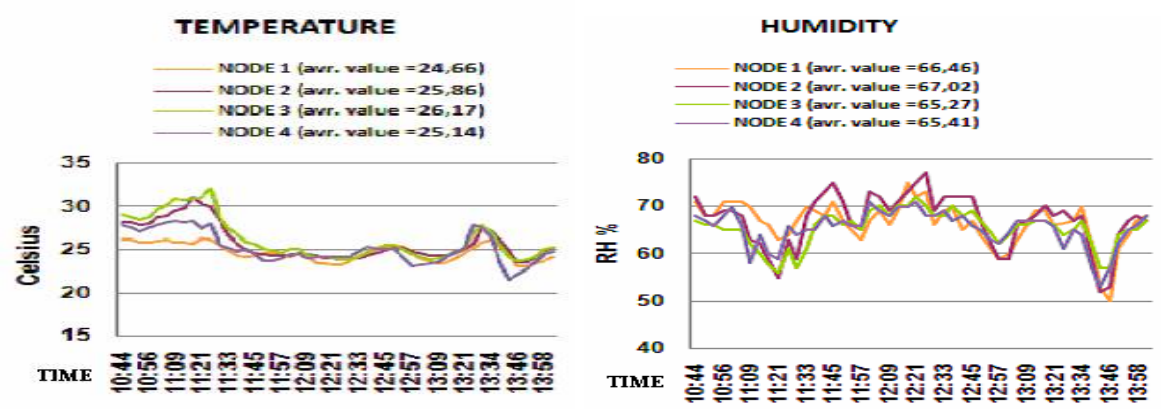


Status of Field on Web Page





VI. CONCLUSION

The main objective of this paper is to design a fully automated drip irrigation system. The system provides a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently. By continuously monitoring the status of the soil, we can control the flow of water and thereby reduce the wastage.

The system also provides the communication interface. The data collected by the system can be send further for analysis purpose. Using this system, one can save manpower, water to improve production and ultimately increase profit.

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Thus, this system avoids over irrigation, under irrigation, top soil erosion, reduce the wastage of water and the crop damage can be rectified. The main advantage is that the system's action can be changed according to the situation (crops, weather conditions, soil etc.). By implementing this system, agricultural, horticultural lands, parks, gardens, golf courses can be irrigated. Thus, this system is cheaper and efficient when compared to other type of automation system. In large scale applications, high sensitivity sensors can be implemented for large areas of agricultural lands. A stand by battery or solar cells can be implemented which comes into use in case of power cuts.

VII. FUTURE WORK

Water resources can be utilized efficiently and effectively based on various other parameters so that agricultural sector becomes more productive. Automatic drip irrigation at different seasons is another future scope. Water is allowed to the field of crops depending upon the particular season. Some more parameters such as plant growth at different stages, weather condition are to be taken into account to determine the water requirement for the crop.This will improve agriculture leading to economical development of our nation.

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