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Design and Implementation of Proficient System for Effective Production in Agriculture Era Using Sensors and Wireless Technology

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Abstract— *In Human life Agriculture plays an important role and it is a backbone of a nation. Farmer depends upon traditional orthodox way of farming. The farmer uses various irrigation methods depending upon the plaguing area. The performance of the system varies from time to time and also involves man power for the purpose of cultivation. A Farmer facesa lot of barriers during the process of cultivation. Furthermore, many irrigation systems have been designed in order to gain farmer's interest in the field of agriculture (N. Shah et al., 2008). The major problem of the agriculture is the equal distribution of water all over the field in spite of the varying climate conditions. In this paper, the proposed system is helps the formers to strengthen his interest towards agriculture and cultivation .Conventional method of exiting system of irrigation requires involves human effort and the proficient system has been designed to conserve water. When the moisture level lower than the required unit.it commands the system to supply water to the field. As soon as the moisture reaches its required level, it automatically commands the system to shut down the water supply. This system involves sensors like humidity, moisture level, temperature level sensors and devices like LCD display unit, GSM, ZIGBEE and PIC 16F877A microcontroller for controlling the operation.*

Keywords— Sensors, Solenoid valve, PIC Microcontroller, ZIGBEE, GSM, SMS.

NOVELTY STATEMENT

Agriculture plays a vital role in human life and it is considered as the backbone of a nation. The major problem that has to come across is the equal distribution of water all over the field in spite of the varying climate conditions. Thus the proposed system is helps the formers to strengthen his interest towards agriculture. The existing conventional method of irrigation requires involves human effort and the proficient system has been designed to conserve water as well as to save human efforts.

I. INTRODUCTION

The word Agriculture is derived from Latin words *Ager* and *Cultura*. *Ager* means land or field and *Cultura* means cultivation. Agriculture has been playing a vital role in economy of many countries. Agriculture is the basis of life of the population by producing food and important raw materials. Almost all the farmers still depend on the traditional orthodox way of farming. Ancient methods of planting are still wide spread in many countries.

Agriculture is the backbone of Indian economy. The sector plays a vital role in the development of India with more than 60 percent of the country's population deriving their subsistence from it. Most of the industries also depend upon the agriculture sector for their raw materials. The rapid growth of agriculture is essential not only for self-reliance but also for meeting the food and nutritional security of the people. It also helps to bring equitable distribution of income and wealth in rural areas as well as to reduce poverty and improve the quality of life. According to market dynamics India has improved its position in agricultural and food exports to 10^{th} level globally, backed by policy impetus by the government. Indian state such as Tamilnadu achieves the highest yields in rice and sugarcane. Haryana enjoys the highest yields in wheat and coarse grains and Karnataka does well in cotton. Bihar does well in pulses, while the other states do well in horticulture, aquaculture, flower and fruit plantations (Y. Kim, R. Evans *et a*l., 2008).

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Most of the agricultural products are yielded by increasing the product cultivation. Thus, the cultivation of every product increases every year that is shown in (Table 1). Movement of agricultural products within India is highly regulated, with inter-state and even inter-district restrictions on marketing. There are a number of productivity crops that are yielded by various hectares in the average field of corresponding years (Zheng Yao, *et al*., 2010.).

India is ranked first in the production of milk, pulses, jute and jute-like fibers, second in rice, wheat, sugarcane, groundnut, vegetables, fruits and cotton production; and is a leading producer of spices and plantation crops as well as livestock, fisheries and poultry.

TABLE 1
POSITION OF INDIA IN WORLD AGRICULTURE

Agricultural Position of India Commodity	Position of India		
	Percent Share	India Rank	Next to India
Tea	26.10	1	-
Sugarcane	22.10	2	Brazil
Groundnut	21.20	2	China
Cotton	11.30	3	China, USA
Cereals	11.10	3	China, USA
Vegetables	9.40	2	China
Fruits	8.80	2	China
Potatoes	7.80	3	USA, Japan

Indian agriculture includes a mix of traditional and modern farming techniques. In some parts of India, traditional use of cattle to plough farms remains in use that is shown in (Table 1). Traditional farms have low productivity and farmer incomes. It is necessary to adapt efficient irrigation methods that are technically feasible, economically viable and socially acceptable. The different types of irrigation systems have been adapted by our country for constant cultivation of crop yields. They are drip irrigation, surface irrigation, furrow irrigation etc. Although water is a renewable source for effective production, the source of water is annual rainfall that is affected by a number of factors. Rainfall in India is highly variable, irregular and undependable with widespread variation among various meteorological sub-divisions in terms of distribution and amount. The highest and lowest annual average rainfall in India is 10,000 mm (Khasi-Jaintia Hill, Meghalaya) and 100 mm in Rajasthan, respectively. Figure 1.6 clearly shows the conservation of water in a house. Irrigation is established for conserving water and it can be classified as surface irrigation, furrow irrigation, drip irrigation etc.

The world population will be well-fed by 2030.The number of hungry people in developing countries is expected to decline but Sub-Saharan Africa is needs for a serious concern. Much of the future food production will reach higher productivity. The expansion of farmland for food production will be slow when compare to the past. Whereas the necessity of water increases according to the population.

This paper presents the importance of conserving water for many applications, which can monitor and control motor and other devices using locally built input and output peripherals. World population will grow from 6 billion to 8.3 billion people in 2030.

Previously many authors have invented various methods for conserving wastage of water. When the disadvantage of one method is solved by a new method, the new method has its own drawback. Some previous methods of irrigation system, the GSM based sensory networks and monitoring systems are discussed here.

Some researchers developed a monitoring system to measure the water level in agriculture using sensor which offers precision irrigation. In previous decades, increase in agriculture production was mostly brought out by the increase in average under cultivation, utilizing virgin and suitable land. One of the important factors in increasing production land is the correct use of water. Therefore, water is the first and foremost limiting factor in raising agricultural production.

Karthik Maddipatla and J. Avinash, was explained that farming was an activity that depended upon the condition of the environment surrounding the agricultural field. The work of the farmers was affected by the natural conditions such as climate, topography and other anthropogenic elements. This analysis proposed to develop a system that makes use of GSM and SMS technologies which allow the remote access of the agricultural motor, thereby making a farmer's work much easier and less dependent.

M. Haefke developed a ZigBee based on smart sensing platform for monitoring environmental parameters such as temperature, relative humidity, pressure and sunlight with the use of microcontroller which serve as a smart weather station. The research was based on the use of low cost equipment, accurate sensors and flexibility in data handling. Use of XBee module provided the wider range and reduced the current consumption of the circuit. The analysis was done by fabricating six prototype weather stations tasting for more than 24 hours. For better results, analysis system had to be reviewed more times.

II. MATERIALS AND METHODS

2.1 Experimental Details and Treatments

The effectiveness of agriculture depends upon various environmental parameters such as soil temperature, soil moisture and relative humidity. This paper proposes a framework of research on developing country value chains to deal with the gap in the literature (Q. Wang *et al*., 2010; Aziz, M. Hasan, *et al*., 2010).

Although the paper addresses various sectors of the economy, the major focus will be on agriculture and preservation of water. The proposed methodology has been divided into two parts such as transmitter and receiver section. The block diagram of transmitter section is shown in (Fig.1).

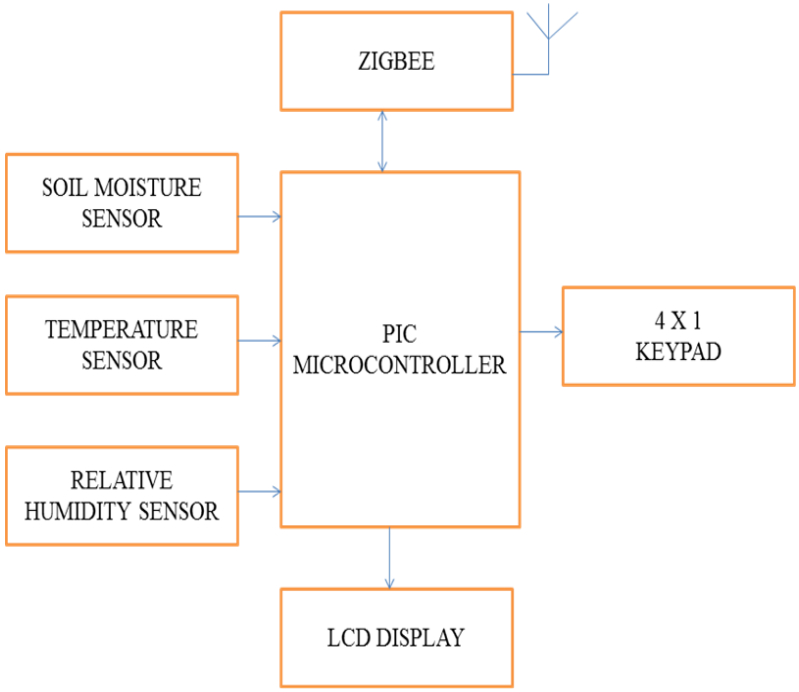

FIG. 1: BLOCK DIAGRAM OF TRANSMITTER SECTION

2.2 Transmitter Section

Circumstances that we find ourselves in today in the field of microcontrollers had their beginnings in the development of technology of integrated circuits. This development has made it possible to store of transistors into one chip.PIC hundreds thousands is a family of architecture microcontrollers made by microchip technology, derived from PIC1640 which has originally developed by General's Microelectronics Division (GIMD) (G. R. Mendez, *et al*.,2011). The name PIC initially referred to "Programmable Interface Controller"(PIC) which were popular among the industrial developers and hobbyists alike its low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

Sensors are sophisticated devices that were frequently used to detect as well as to respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically. The mercury in the glass thermometer expands and contracts which can be read by a viewer on the calibrated glass tube.

This device collects information about temperature from a source and converts it into a form that is understandable by other device or person. The best illustration of a temperature sensor is mercury in glass thermometer (M. Haefke, S *et al*., 2011). The mercury in the glass expands and contracts depending upon the alterations that occur in the temperature. The outside temperature is the source element for the temperature measurement. The position of the mercury is observed by the viewer in order to measure the temperature. The humidity sensor is a three-wire sensor which use, the red wire for positive voltage, the white wire for the output signal, and the black wire for ground (Zhang Feng, 2011). A humidity sensor utilizes a thin polymer that varies in dielectric constant directly proportional to changes in the amount of water vapor at the sensor element. The element provides a linear voltage output that is converted into a 4-19 mA sensor output signal.

2.3 Receiver Section

GSM is a TDMA based wireless network technology developed in Europe that is used throughout the world. GSM phones make use of a SIM card to identify the user's account. The use of the SIM card allows GSM network users to quickly move their phone number from one GSM phone to another by simply moving the SIM card. Currently GSM networks operate on 850MHz, 900MHz, and 1800MHz and 1900MHz frequency bands. Devices that support all four bands are called quad-band; those that support 3 or 2 bands are called tri-band and dual-band, respectively (M. Dursun *et al*., 2011). In the United States, Cingular operates on 850 and 1900MHz bands, while T-Mobile operates only on the 1900MHz band. GSM supports voice calls and data transfer up to 9.6 kbps, together with the transmission of SMS (Short Message Service).A GSM modem requires a SIM card from a wireless carrier to operate smoothly.

The APR960 device offers true single-chip voice recording, non-volatile storage and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, microphone amplifier, and AGC circuits greatly simplify system design fig.2. The device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications. APLUS integrated achieves these high levels of storage capability by using its proprietary analog/multilevel storage technology implemented in an advanced Flash non-volatile memory process(M. Dinesh *et al*., 2011), where each memory cell can store upto256 voltage levels. This technology enables the APR9600 device to reproduce voice signals naturally. It eliminates the need for encoding and compression, which often introduces distortion. The receiver section also consists of PIC microcontroller to multiplex the data. ZIGBEE are placed in the receiver section and were used to receive the data held by the transmitter. Solenoid valves were used to supply the sufficient water to the field and the GSM to send the SMS along with an APR(voice call) to the farmer for him to know that which field area valve is on the switched on mode and which on the switched off mode. LCD placed in the receiver section displays the status of the motor whether it is switched ON or OFF (Singh *et al*., 2011).

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III. RESULTS AND DISCUSSIONS

The result has been discussed here to evaluate our proposed system over existing one. We estimate here that the cultivation of various products have been increased as the wastage of water has been decreased as per data is shown in the graph (Fig.6) (Xihai Zhang, *et a*l., 2010).

This paper comes forward with two empirical results such as transmitter, receiver and also simulation. The hardware system had been designed and tested using a pumping motor at an agriculture field located at the distance of 60 meters from the user's location. The motor operated successfully as it automatically controlled the two solenoid valves 1 and 2 completely i.e. when the solenoid coil is energized the corresponding valve gets opened and the another valve closed as per shown in the (Fig.3) and (Fig.4).

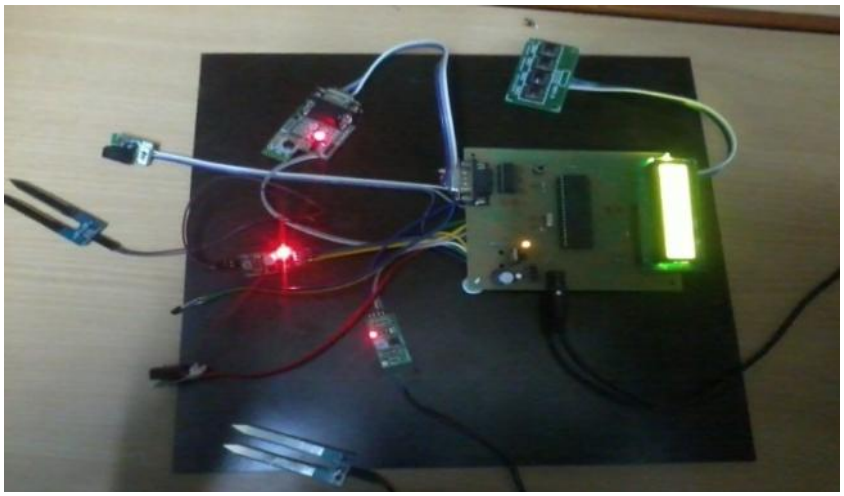

FIG. 3: PHOTO SHOT OF DESIGNED TRANSMITTING SECTION

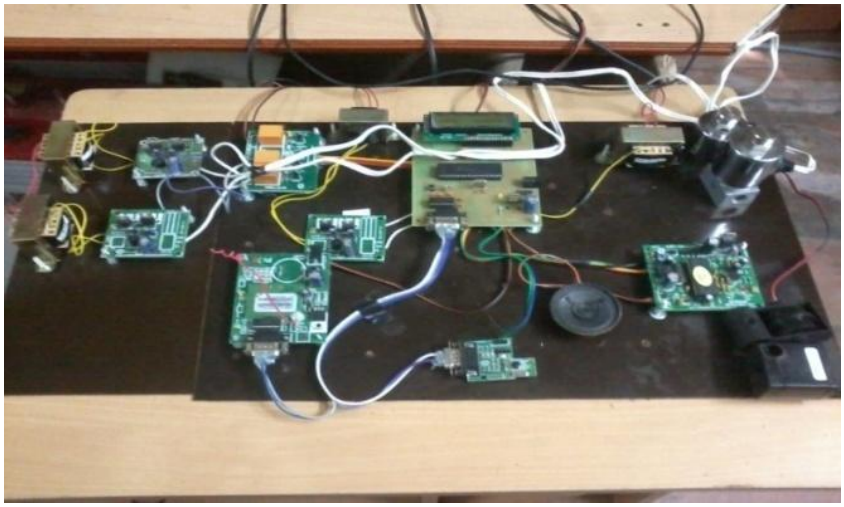

FIG. 4: PHOTO SHOT OF DESIGNED RECEIVING SECTION

Transmitting section consists of two soil moisture sensors, two humidity sensors and one temperature sensor for monitoring the two various field areas shown in (Fig.3) which acts as slave node. These sensors were used to monitor the physical parameters of the area throughout. Sensors were used to send information to the controller as input. If the levels of field area had been changed, through ZIGBEE, a command signal is passed to the receiver device.

Similar to the transmitter block, receiving device also has a ZIGBEE to receive information shortly the owner receives the SMS as well as the voice message. According to the software simulation the process was built using Proteus software, in which Embedded C programs had been built in that for the required application as per shown in (Fig.5).

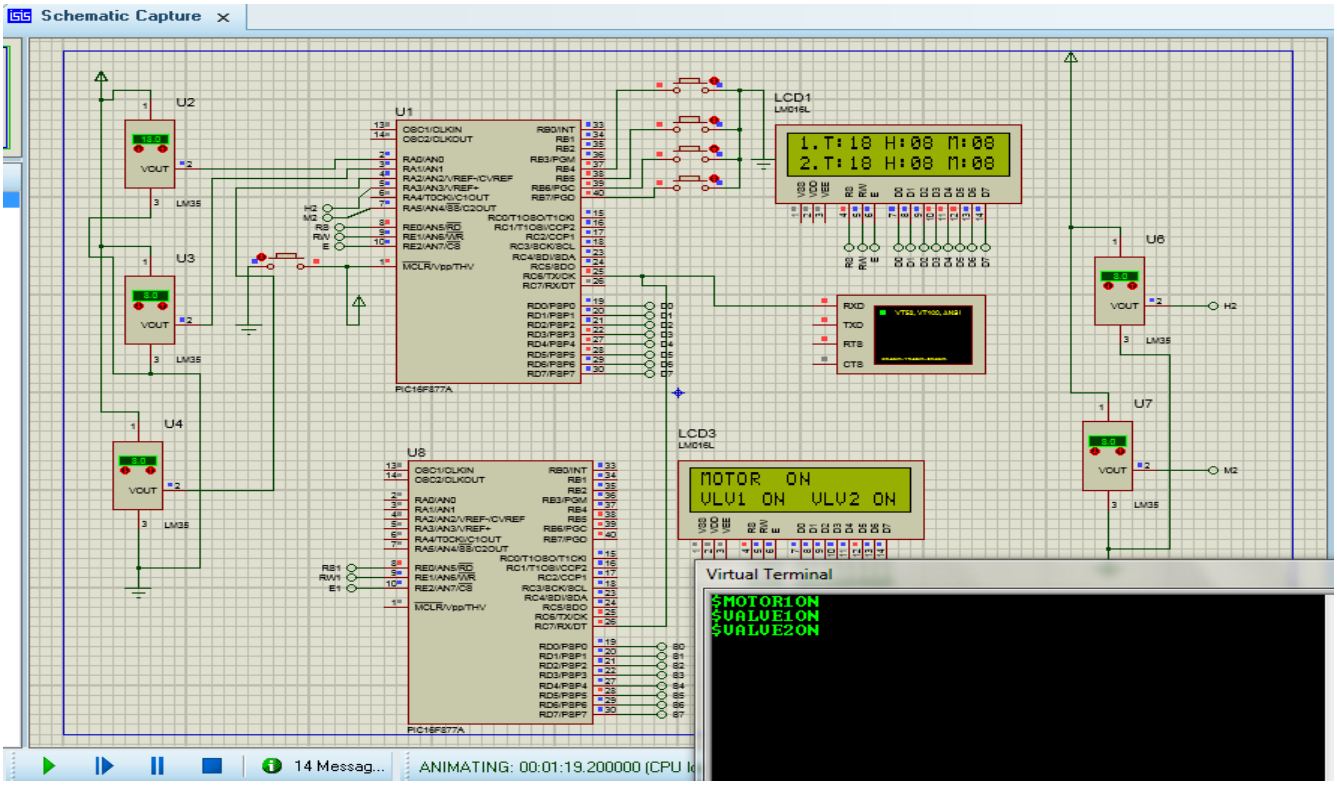

FIG. 5: RESULT OF SOFTWARE SIMULATION

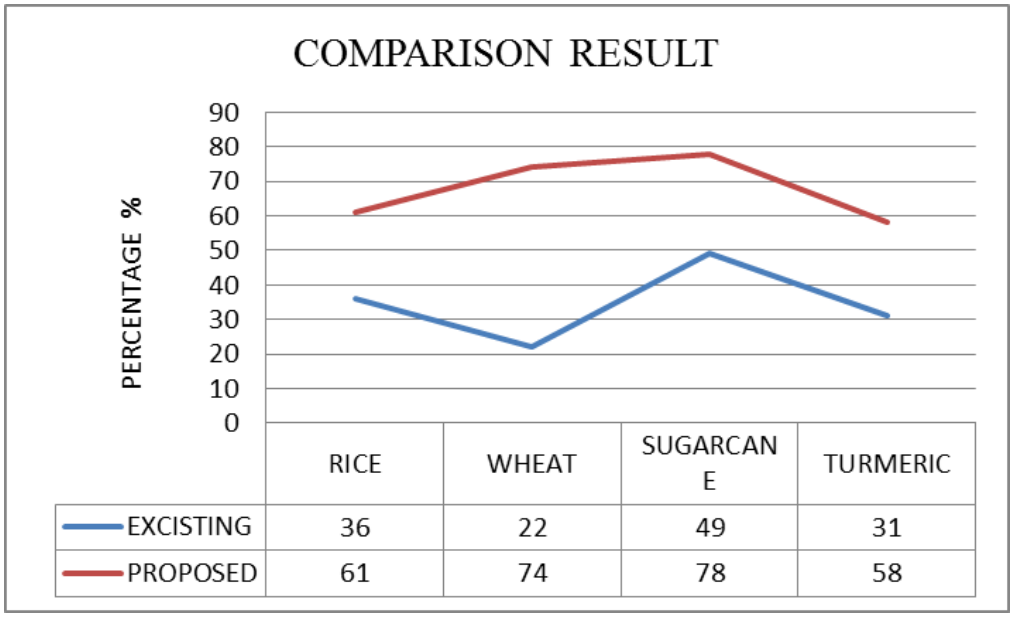

FIG. 6: COMPARISON RESULT

IV. CONCLUSION

Modern agricultural irrigation is a complex interplay of sustainable energy consumption, water use, market conditions and the application of experience and knowledge to ensure the best design for irrigation applications. Understanding past practices, current water and energy issues, and developments in pump technology contributes to building a pumping system that best serves the needs of modern agriculture. The main contribution has resolved by using wireless mediums, sensors and automatic pumping systems. This automatic pumping technology that have obtained will entirely reduce the usage of man power and reducing the water level. Usage of water has become more complex in the present scenario but the proposed system provides better output as it is more efficient by nature.

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