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Automated Irrigation System Using GSM Module

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Abstract: **- The increasing demand of the food supplies requires a rapid improvement in food production technology. In many countries where agriculture plays an important part in shaping up the economy and the climatic conditions are isotropic, but still we are not able to make full use of agricultural resources. One of the main reason is the lack of rain & scarcity of land reservoir water. Also, the unplanned use of water inadvertently resulting in water wastage. The aim of our project is to minimize the manual intervention of the farmer, which is why we are using a micro-controller PIC- PERIPHERAL INTERRUPT CONTROLLER. It's done using a GSM MODULE attached with the Automated Irrigation System. The micro-controller based AUTOMATED IRRIGATION SYSTEM will serve the following purposes: 1) As there is planned usage of water, a lot of water is saved from being wasted. 2) The soil is irrigated when there is not enough moisture in the soil and the microcontroller decides when should the pump be turned on/off . 3) The water level Indicator checks the amount of water in the water container. Thus this saves much time of the farmers, as they don't have to go and turn the pump on/off manually by monitoring various soil parameters for controlled Irrigation.**

***Index Terms*— Controlled Irrigation, GSM- Global System for Mobile Communications, Microcontroller, PIC Peripheral Interrupt Controller, Soil Parameters, Water Level indicator.**

I. INTRODUCTION

The main aim of our work is for effective utilization of water. Water is useful for all living organisms and it's the human being who is mainly responsible for wastage of water. There are many sources by which human makes the water hazardous for other living organisms ,plus there are many ways by which human being is responsible for wastage of water. One major reason of which is unnecessary wastage of water in agriculture field due to unawareness of farmers about sufficient supply of water. There are many plants that are very sensitive to water levels and they required specific level of water supply for proper growth, if this not they may die or results in improper growth. It's hardly possible that every farmer must possess the perfect knowledge about growing specifications of plants in case of water supply. In Indian economy seventy percentage part is depend on agriculture and under this condition if there will be any system which will help to provide precise level of water to plants then it will definitely leads to beneficial for our economy. So to help them we are making an attempt by introducing our project "Automated Irrigation System". By using sensors in our work we will make them aware about changing conditions of humidity level, pH level according to weather so according to changing conditions of humidity they will be able to schedule the proper timing for water supply.

Disadvantages of manual irrigation:

- Labour intensive
- User need a basic training to install and use the correct most of the method
- Due to the lack of electricity and mismanagement in the manually controlling systems, sometimes their fields become dry and sometimes flooded with excess water [1].
- Manual subsurface drip irrigation avoids the high capillary potential of traditional surface applied irrigation, which can draw salt deposits up from deposits below.

Why go Automated?

- Eliminates the manual operation of opening or closing valves
- Possibility to change frequency of irrigation and fertilization processes and to optimise these processes
- Use of water from different sources and increased efficiency in water and fertilizer use
- System can be operated at night, water loss from evaporation is thus minimised
- Irrigation process starts and stops exactly when required, thus optimising energy requirements .
- Most of the time valves are left open which lead to wastage of water hence we go automated.[2]

Basic Work Principle of the module

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The inputs to the PIC are the soil moisture, humidity sensor ,p H sensor ,water level indicator & the outputs are the message to the farmer and the water pump being on or off as required by the designated user of the GSM module . If there is enough moisture, the water-pump does not start. But, if the sensor detects no moisture presence in the soil, it signals it to the PIC, which in turn drives the water-pump. After the soil moisture is checked and if dry the sensor detects accordingly and irrigates the field thereafter sends an informative message to the farmer and accordingly the farmer switches on or off the irrigation pump with the help of his assigned GSM number by which he can send the activation or deactivation code to the module for the pump to start or stop accordingly as per the required moisture needed for the irrigating the field accordingly. This paper discusses and review PIC applications, especially by monitoring soil parameters for effective irrigation.

II. RELATED WORK

An Automated Irrigation System which is used to control Irrigation parameters and send the information regarding soil, water and pH levels to farmer mobile using GSM Technology. Basically, there three main modules pH sensor, soil moisture, ultra sonic sensor, a microcontroller which is programmed to control the water flow to the farm and send information to the farmer mobile through GSM network, a power module to provide the required power. Therefore, SMS systems represent a promising technology because of the water savings that they can achieve during wet weather conditions while maintaining acceptable soil quality [3]

Figure 1:. GSM module

Wireless GSM module increases mobility and hence doesn't affect the growth of the growing crops. Traditional instrumentation based on discrete and wired solutions, presents many difficulties on measuring and control systems especially over the large geographical areas [4]. The Water Level Indicator on the storage system gets Water levels of tanks using a principle on Ultrasonic Wave Propagation system with Microcontroller integration [5] The Electronic embedded system is connected with a Water pump. Irrigation management and irrigation scheduling- the process used by PIC to determine correct frequency and duration of watering, are important to ensure the efficiency use of water and high quality of crop yield [6] The rapid increase in GSM deployment in communication applications is due to its characteristics of being a low power and low data rate hence energy efficient technology. It also offers mobility and flexibility in connectivity which promote network expansion when needed [6].

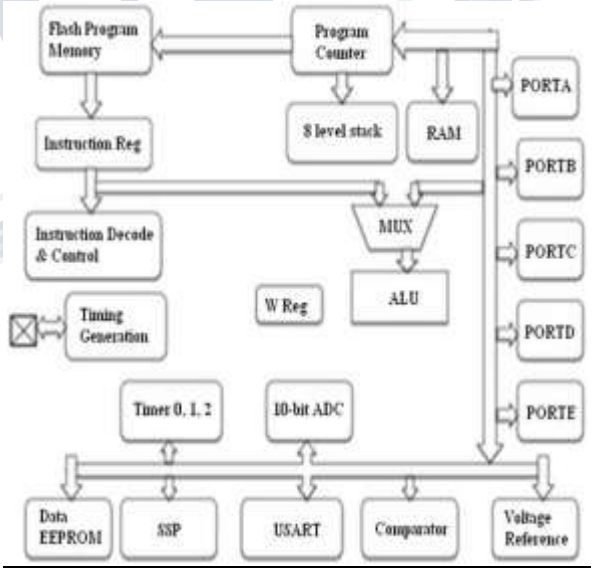

Figure 2: ARCHITECHTURE OF PIC16F877

The PIC is a high performance microcontroller (PIC 16F887), offering excellent quality, fast response, anti interference ability and it is cost effective [7].The module is operated by battery power are used to monitor and control the soil parameters from remote locations [8]. All these comprise

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of 4 basic modules including pH and Moisture Sensor module, GSM module, PIC chipset module and power module (battery). [9] The related data is collected cumulatively by various sensors and is processed by an embedded system and it is transmitted to the user and the decision is sent by a wireless GSM communication network which provides remote monitoring and management of data [10, 11]. As stated by Liu Junfeng et al. [4] the various auto irrigation systems are urbanized but their communication methods incorporate cable communication and have various shortcomings. These include difficulty of installation, safeguarding, expensive finance and complexity. Some economical systems are present which makes use of SMS or miss call facility, for control operation but eventually leads to ambiguity while performing the operations involved in various controlling actions. Hence, an Interactive Automated System needs to be developed. This paper discusses and reviews the many applications of PIC and the GSM Module, especially by monitoring soil parameters for effective irrigation. UB Desai et al**.** [12] presented various technical aspects of GSM deployment and its uses in agriculture to monitor and compute infection index values based on pH, moisture and crop conditions. Noman Islam et al. presented several requirements for the agriculture domain [9]. Collection of weather, crop, pH Moisture and soil information, monitoring of distributed land multiple crops on single piece of land, different fertilizer and water requirement to different pieces of uneven land, diverse requirements of crops for different weather and soil conditions will help to react on different situations. Our AIS module is tested in various soil conditions whether it be sandy or marsh alluvial soil.

III. EXISTING WORK

Population growth, urbanization, and climate change are the main reasons for the global water crisis excessive water use, poor management, and inadequate irrigation. According to the United Nations World Water Development Report, 70% of freshwater worldwide is used for irrigation. Recent studies have unveiled that less than 40% of applied water [13**]** 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). To achieve a high accuracy of the wireless monitoring system with soil moisture sensors, which are being attached to the pH and moisture sensor nodes, are calibrated to corresponding soil-specifically. The research study conducted by K.V.S Ram Chandra Murthy (2009**)** [14] shows that demand of electrical energy for irrigation is increasing. Due to urbanization, many regions in India have been facing shortage of power. All this leads to inconvenience for the farmers. Along with this, the scarcity of water and unpredictable nature of the rainfall makes the scenario worst. Hence, an automated irrigation system is required to facilitate the smooth manoeuvre, by eliminating these tribulations.

Pros of the Module

The continuously increasing demand of the food necessitates the rapid improvement in food production technology. In most of the developing countries such as India, national economy mainly depends on the Agriculture. But these countries do not able to make proper use of agricultural resources due to the high dependency on rain [15]. Nowadays different irrigation systems are used to reduce the dependency of rain and mostly the existing irrigation systems are driven by electrical power and manually ON/OFF scheduling controlled [16]. Farmers usually control the electric motors observing the soil, crop and weather conditions by visiting the sites. These manually controlled irrigation systems cannot ensure a proper level of water in the site. Due to the lack of electricity and mismanagement in the manually controlling systems, sometimes their fields become dry and sometimes flooded with excess water .These unplanned and manually controlled irrigation systems also cause a significant amount of water waste Automated irrigation system is usually designed for ensuring the proper level of water for growing up the plants all through the season. Even when the farmers are away, these automated irrigation systems always ensure the proper level of water in the sites [17] In addition, it provides maximum water usage efficiency by monitoring soil moistures at optimum level [18]. Several research works have reputed aspects of development of automated irrigation system [19, 20 21, 22, 23].With the development of technology in water saving irrigation and automation, automated irrigation is going to be more popular in the farms.

Cons of the module

PICs and GSM module's are still under developmental stage; as such, they are at times unreliable,

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fragile, power hungry and Can easily loose communication when deployed in a harsh environment like agricultural field [24].

IV.METHODOLOGY

The development of the code for proposed work may achieve and tested with the Mplab Ide software which is feeded into our PIC16F877A microcontroller and provides good and accurate results with future usage and other resources present in the developed application The code mainly explains that the ADC converts the analog values to digital values by taking in the values from ports R0, R1, R2 and the output is given out from port R4. The PIC has 4 ports which is responsible for the giving of the inputs and getting the desired outputs. The PIC receives the desired input from the various sensors in the digital form as the ADC converts these values for the PIC to compile and hence executes these codes so as to check the moisture content of the soil and then send a informative message to the user that is the farmer whether or not to irrigate the farm. He receives the message whether the soil is dry or not with the help of some threshold values which helps the farmer to determine to irrigate the field or not. If he wants the field to get irrigated he will send **ONN.** As the message for the pump to switch on .To save power he can switch the module off by sending the message **OFF.** .

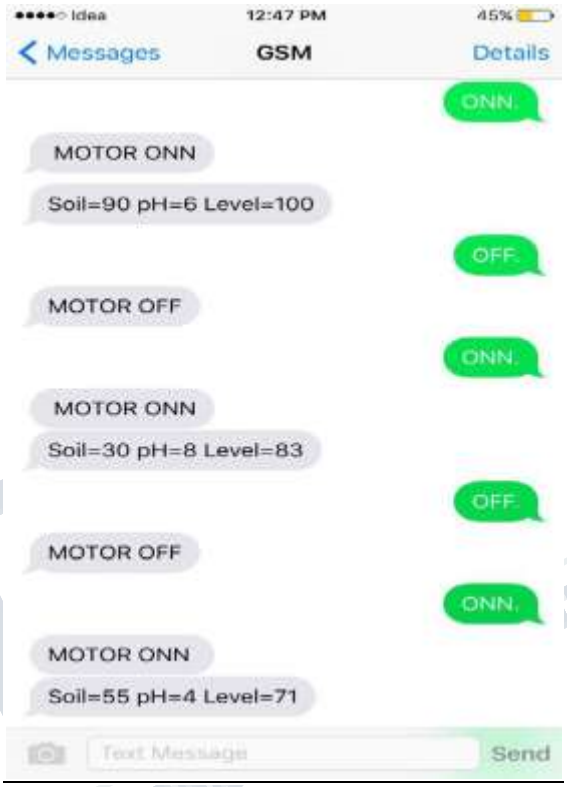

Figure 3: Transmission and Reception Of SMS

V. DESIGN AND IMPLEMENTATION

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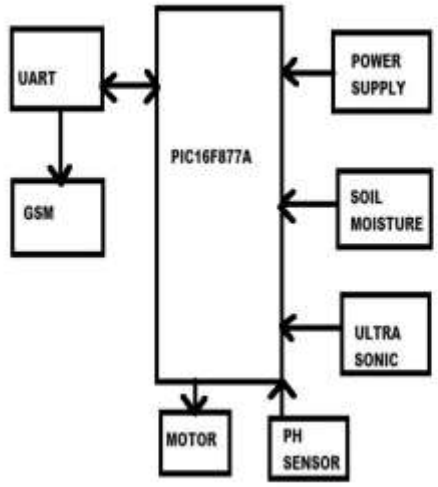

FIGURE 4: AIS Block Diagram

The powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into an 40- or 44-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. The PIC16F877A features 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications hence this PIC is the heart of the model which is further interconnected with the sensors, Input Amplifying boosters, UART, Water Level Indicators, Battery and the GSM Module. Thus incase of any mishap or circuit interconnection problems just the replacement of the PIC or the Battery will solve the circuit problems which can be done by the user even if they are not that proficient in the technology such as a modern day farmer. We presume that the user will have enough knowledge on operating on a GSM mobile communication device.

VI. PERFORMANCE ANALYSIS

After calibration, the prototype system is installed in the field to monitor a test area primarily to test the capabilities of the module's mobile agents with respect to performing cooperative real-time diagnoses of the soil moisture conditions and reacting appropriately of changing site conditions. The area is divided into two monitoring regions. In each region, one wired pH and moisture sensor node is installed, hosting the mobile agents as described earlier. The GSM Module is interfaced and is connected to the onsite computer, a laptop computer located next to the test area, through the base station. The module is Equipped with a Local area SIM (Subscriber Identity Module) in order to receive and transmit messages without any problems related to network connectivity .Thus the module activates or deactivates the pump as per the command given by the user and hence it's seen to be greatly efficient saving both water and ,users time.

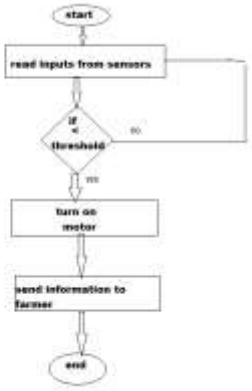

Figure5: Flow Chart Of Execution

Soil type	pH	moisture
Black soil	8.5-9	40-50%
Old Alluvial soil	4	50-60%
Red soil	6.6-8	20-30%
Alluvial soil	6	80-90%

Table1: Case Study Of Different Soils

VII.CONCLUSION

The aim of the project which is used to control Irrigation parameters and send the information regarding soil, water and pH levels to farmer mobile has been successfully accomplished by using GSM technology. By this project we

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are able to irrigate fields without manual intervention, with the help of the GSM module automatically but there is a quandary that it can only be operational in places where there is complete network coverage .This project is able to irrigate every type of soil, but the module rules out the possibility of irrigation soil like sand and marsh soil. Thus we are able to irrigate the various agricultural fields saving water and manpower.

VIII.APPENDIX

GSM MODULE

MAX232 IC:

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits, so that devices works on TTL logic can share the data with devices connected through Serial port (DB9 Connector)

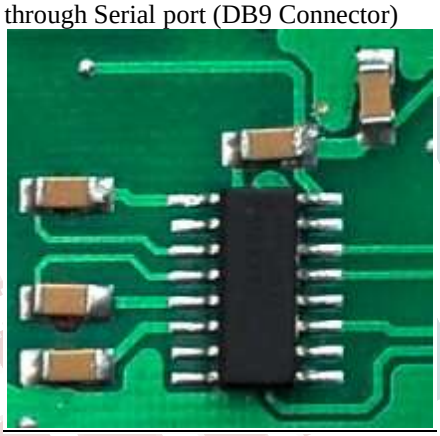

FIGURE 6(MAX232 IC)

Serial port / DB9 connector:

User just needs to attach RS232 cable here so that it can be connected to devices which has Serial port / DB9 Connector.

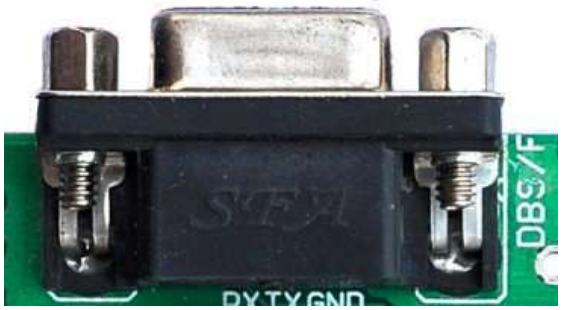

FIGURE 7 :(DB9 Connector)

SIM (Subscriber Identity Module)

Card Slot:

This onboard SIM card slot provide User functionality of insert a SIM (GSM only) card of any service provider. Process of inserting and locking SIM card into SIM card slot is given in this manual

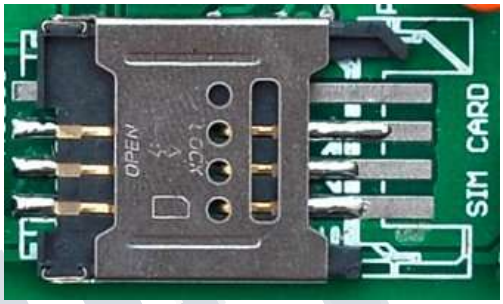

FIGURE 8 (SIM Card slot)

Network LED:

The Network LED indicates the various status of GSM module e.g. Power on, Network registration. When the modem is powered up, this NETWORK LED will blink every second. After the Modem registers in the network (takes between 10- 60 seconds), this LED will blink in step of 3 seconds at slow rate. At this stage you can start using Modem for your application, showing that modem is registered with the network.

RXD, TXD and GND pins (JP2):

These pins are used to connect devices which needs to be connected to GSM module through USART (Universal Synchronous Asynchronous Receiver and Transmitter) communication. Devices may be like Desktop or Laptop Computer System, Microcontrollers, etc. RXD (Receive Data) should be connected to TXD (Transmit Data) of other device and vice-versa, whereas GND (Ground) should be connected to other device's GND pin to make ground common for both systems.

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FIGURE 9: (pin slot)

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