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Remotely controlled agricultural pump

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Abstract:

Agriculture is a source of living for the majority of people in India. All the people are directly dependent on agriculture for food. In a country like India, where the weather conditions are not even throughout the year and rainfall differs every year, irrigation facilities for agriculture are not easily available. Many farmers rely on groundwater for irrigation. For groundwater to reach the surface, bore wells and pumps are used. There is a lot of inconvenience and danger associated with manually switching ON/OFF the motor. Many incidents of electrocution and snake bites are reported due to manually controlling the motor at the physical location of the motor.

So, we make use of IoT, Android and GSM technology to control the motor remotely using mobile phones (Smartphone/feature phones). A remote user can send commands from his mobile phone such as to switch ON/OFF water pumps using an android application or by sending simple text messages to supply water for the plants for a certain duration. By using sensors attached to the system, the user can acquire the temperature, humidity and soil moisture information of the field.

Introduction:

In India, the major occupation is farming and farming requires water for irrigation. Some sources of water are canals, ponds, rainwater, streams, etc. Many places do not have any other source than rainfall and groundwater. Rainfall is not predictable and is not even in India. Due to this reason, many farmers depend on groundwater for irrigation. They use bore wells to bring water to the surface and there are many risks and efforts are involved in controlling the bore well pumps. There is no 24 hour power supply for irrigation in most of the areas. So, the farmers have to wait for the electricity supply and sit in the farm. There are

many reported incidents of electricity shocks due to touching the motor starter directly with bare hands. These incidents occur due to loose connections or wet hands of farmers. There are also cases of snake bites while going to switch on/off the pump. Snakes try to stay in the motor starter boxes or the farmers without seeing the snakes, step on them during night time. So, when the farmer goes to switch the motor, they become victims to snake bites. Despite all these dangers, the farmers need to control the motor as their fields need water. Without water, the crops cannot grow and the farmers' lives become miserable.

Remotely controlled agriculture pumps can minimize the risks involved in physically controlled pumps. The farmer needs to touch the starter and this minimizes the risk of getting electrocuted. The farmer can stay at home and control the pump using his mobile phone. This minimizes the risk of snake bites or thunder attacks in the fields. We achieve these using two methods. The first method is using the internet. We have a wifi module connected to the motor and an android app is developed so that the user through this app sends on/off signals over the internet to control the pump. The sensors attached to this module read the information and the module sends this information to the application through the internet/cloud. All the areas in India do not have internet facilities and the fields are located in villages where internet signals are really poor. Also, all the farmers do not use smartphones and many farmers do not have the operational knowledge to use a smartphone. Some farmers cannot afford a smartphone. Most of the farmers have feature phones and they can easily operate them. The second method comes into picture in this use case. In this method, we use the GSM module instead of the wifi module. In GSM mode, the pump can be controlled by sending a simple SMS to the sim inserted in the module. Smartphone users who do not have internet connectivity at motor or in mobile, can make use of GSM mode. The android application is designed in such a way that it can be used to control both via the internet and SMS.

Problem Statement:

Inconvenience in switching on/off a water pump installed in a remote farm is a common problem faced by farmers. When it is the time to water the farms, they just stop their current works then and they will go to the farms to start the pump sets to water the farms. This is a waste of time and energy as the fields of many farmers are located far away from their homes.

Also, physical contact with the electric system has led to many accidents in agricultural fields. There have been reported incidents of farmers getting electrocuted leading to death of many of them. Incidents also report snake bites and thunder attacks while going to switch on/off the motor.

The farmer has to continuously monitor the physical state of the field by going to the field and checking it. This is also a tedious task and involves time and effort.

All the above problems occur due to directly going to the farm and switching the motor on/off by being present there.

Solution Framework:

The proposed system is completely remote handling of the pump using a mobile phone.This system can be implemented by both smartphones(using android application) and basic phones(using SMS).Many rural areas do not have internet connectivity and most of the farmers use feature mobile phones. So we have also integrated GSM module so that the pump can be controlled using SMS.Motors can be automatically controlled by using controllers and there is no need of labor to turn motor ON and OFF.The system also uses sensors to measure moisture of the soil and temperature in the field and sends the information to the user so that the user gets to know how much water to be supplied without visiting the field.

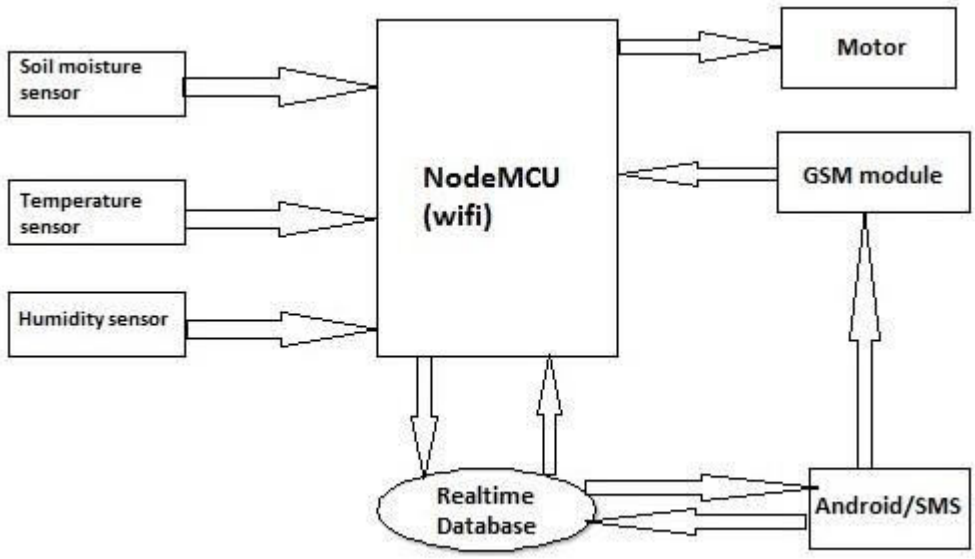

Figure 1:Block diagram.

Workflow:

When the farmer wants to switch on the motor or switch off the motor, he opens the android application in his mobile phone and can check the sensor values like temperature and soil moisture. If the conditions require water, he switches on the pump by clicking the motor on button. The ON signal is sent to the real-time database (Google firebase) which is connected to the wifi module through the internet and the wifi module sends the signal to the motor to switch ON. The sensed sensor values are continuously updated to the real-time database and the android application collects these values and displays them to the user. If the ideal conditions are met, the farmer clicks on the motor off button in the app and the pump is switched off.

If the farmer does not have a smartphone or the wifi module is not connected to the internet, we can use the GSM module. If the farmer wants to switch on the pump, a message with text “1” is sent by him to the mobile number of the sim inserted in the module. If the farmer wants to switch off the pump, a message

with text “0” is sent. The GSM mode is also integrated in the app for simple use of SMS with just a button click.

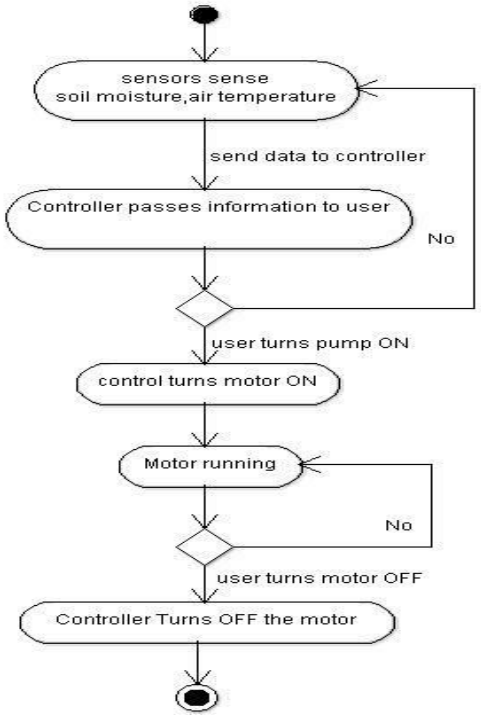

Figure 2: Workflow diagram

Implementation:

We use NodeMCU ESP8266 as a microcontroller and wifi module. This module is connected with all the sensors, relay module and GSM module. We use a relay to interface the motor with a microcontroller. For temperature and humidity, we use a DHT11 sensor and for moisture, we use a soil moisture sensor. For the GSM module,we use SIM800L by connecting the Tx and Rx pins to NodeMCU ESP8266.

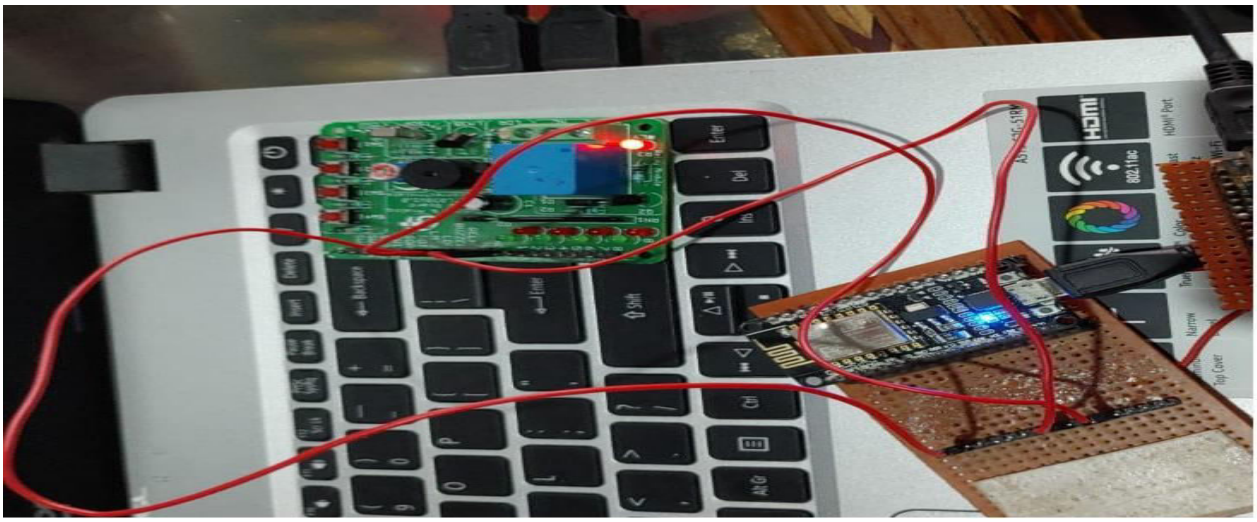

Figure 3:Implementation

Android application is developed by using android studio. The layout is prepared by using xml code and backend code is developed using java.

The application interface is shown as below:

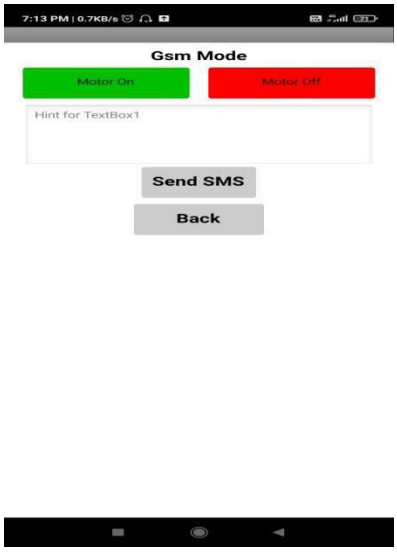

Figure 4.1: wifi mode of app

Figure 4.2: GSM mode of app

Results and Conclusion:

The experiment carried out performs accurate controlling of motor with a responsive delay of few seconds. The project minimizes the risks and efforts involved in going to the actual place of the motor and controlling it physically. The remotely controlled agricultural pump is cheap and easy to install. The application interface is very user friendly and can be used easily by farmers as the buttons are large and easily differentiated with colors. The availability of this system is quite high as it can be used with Wi-Fi as

well as GSM. This system can help a variety of users as it can be controlled by both smartphones and feature phones. Experiments show highly accurate reachability as it has both internet access as well as SMS reachability. Sensors data is useful to monitor the physical conditions of the fields. In all ways, it is beneficial for the farmers with a low upfront investment.

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