IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Solar Powered Irrigation System

NAVDEEP KAPOOR **NIKHIL MALIK** **NITIN** **RAHUL MEENA**

Department of Mechanical Engineering
Delhi Technological University
Delhi, India

ABSTRACT-Farming is the main industry, majority of Indians' principal source of income, it does have a large economic impact on the country. Our research aims to eliminate farmers' physical labour by establishing an automated irrigation system that maximizes the use of land for irrigation crops . This concept was conceived as a result of a planning phase, a combination of sources from places where agriculture is the main source of income and the climate is conducive to a lack of rain and water scarcity. Rain and bore wells are the only sources of irrigation for farmers working on farmland. Even if a water pump is installed in the agricultural field, farmers must use their hands to turn it on and off as needed. The project's purpose is to create a self-contained irrigation system that turns on and off the pump motor based on soil moisture levels. Using the appropriate irrigation technique is crucial in agriculture. This approach has the advantage of requiring less human engagement while still assuring proper irrigation. To construct a software programme, The computer was programmed with the criteria for moisture content, temp, and water level. The management and information on water levels, and the sensing of soil moisture content, are discussed in this work.

INTRODUCTION

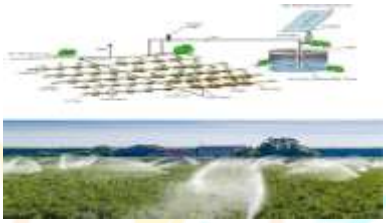
India's economy is one of the world's major developing economies, as we all know. The agricultural sector is the most important contributor to the Indian economy. In order to attain optimal personnel utilisation and profit in a particular time frame, numerous technical methods that are being used must be upgraded .As a result, keeping enough moisture in the soil are among the most basic criteria for producing a good crop that can provide a range of ingredients, both micro and macroeconomic, for optimum growth. When it comes to famines induced by crop failure due to a variety of drought-related factors, Indian farmers are the hardest hit. Rain has an important part in determining the Annually, the existence of such crops, and also the farmers, is in risk. Excessive usage of groundwater resources has led to a significant declines in groundwater table during the previous 15 years. As a result, it is critical that we carefully use each and every drop of water so that future generations can also benefit from it. We should also come up with some novel ways to utilise renewable energy sources. The development of these new solutions will assist us in achieving our goal of sustainable development while minimising greenhouse gas emissions. SOLAR POWERED IRRIGATION SYSTEM is the name of our project, and That's a step in the right direction ,unique eng approaches. This technique will be an excellent solution for small and medium farmers who experience crop failures on a regular basis. The application of this technology has a lot of potential in the near future.

OBJECTIVE AND VISION

The main objective of the study was to make a special irrigated infrastructure that used water more efficiently, decreasing labour costs and eliminating excessive water loss. When settling on a design solution, the following considerations were considered:

Installation costs, water conservation, human interaction, reliability, power consumption, maintenance, and expandability are all factors to consider.

Cost is an important factor in cost segmentation since it determines the feasibility and efficacy of a project. Water conservation was also a major consideration, as there is a need to cut down on waste and increase efficiency. It is also necessary to keep track of power use. Expenses are a significant factor in segment costs since they influence a project's economics and feasibility. Water conservation was also a major consideration, as there is a need to cut down on waste and increase efficiency. It is also necessary to keep track of power use.



SURVEY OF LITERATURE

soil water/moisture sensor, temp detectors in the plant's surrounding soil, and an entrance unit management sensor are all included data and send it to a web site in this report. To manage the amount of water utilised, a single algorithm was devised to measure the Warmth and soil humidity cutoff readings were then fed into a computer. A pv screen was employed to provide power. Other benefit of wireless Web connections is that they are portable & that they can be used to perform automated data analysis and irrigation planning via a web page. The autonomous irrigation system was put to the test for 30 days and found to save 90% more water than a traditional irrigation system. Because of its water-limited geologically isolated zone, the system has the potential to be lucrative. An acoustic-based technique for monitoring soil moisture content was developed in this research. This technology's main goal is to create a system that can measure soil moisture in real time. An Experiment discovered that as the moisture content of the soil increases, the speed of sound decreases, depending on the kind of soil. This study presents a microcontroller-based architecture of autonomous irrigation that relies solely on solar power for power. In the paddy field, a lot of sensors have been installed. Water levels are regularly monitored by sensors, which broadcast the data to the farmer via cellular phone. Without entering the paddy field, the farmer can run the motor. The motor will be turned off without the farmer's consent if the water level reaches an unsafe level. People may be able to convert their tube wells to solar-powered pumps when the price of diesel climbs. As is obvious, acquiring water from rivers and lakes has become a major issue, as farmers are unable to meet their agricultural needs due to a lack of water. Farmers that use tube wells now face a water shortage, which has an impact on their energy source.

PLANNING PROCESS

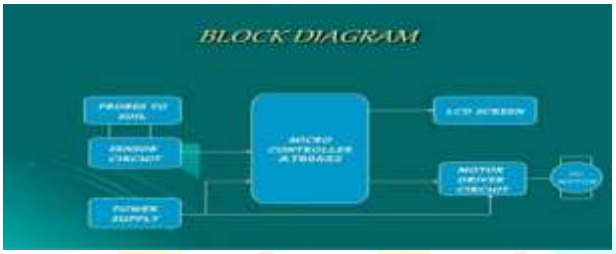
An experimental scale is employed in this work in rural areas where a large number of irrigation systems are controlled by an arm controller and wireless communication. The major goal of this design would have been to show how an automated sprinkler will be used to maximise water consumption. A photoelectric drip irrigation, which would be a global network consisting of an energy from the sun various sensors and a temperature controller put deep in the soil wherever roots are present, may also be the culprit. The existence of liquid in the tank is detected by a moisture sensor in the system. By Coding the margin readings of moisture in the soil water level into a microcontroller, a software programme was updated.

WETNESS OF THE SOIL (moisture)

On a local agricultural scale, as well as in large-scale modelling of the atmosphere interface, moisture is a key component of the environmental water cycle. Plants and vegetation are becoming increasingly reliant. The presence of water accessible at the root level, in opposed to rainfall incidence. Local soil moisture data as well as the real

execution of irrigated action are part of water budgeting and irrigation planning. Assessing the amount of soils dryness can help estimate the likelihood of severe flooding or fog. The weight or quantity of water in the soil is represented by the moisture content, whereas the energy status of the soil water is represented by the water content in the soil. The link among content and capability isn't universal, and it's influenced by factors such as density and texture in the soil. The gravimetric method is the most straightforward way to determine how much water is present in a given volume of soil. This approach is the best model on which all other techniques are measured because it is based on actual measurements.

BLOCK DIAGRAM AND WORKING



SOLAR POWER: Solar power is the utilisation of the sun's energy to generate electricity, either directly as thermal energy (heat) or indirectly through photovoltaic cells in solar panels and transparent photovoltaic glass.

NEED FOR IRRIGATION:

- Drought is caused by an uneven and indeterminate rainfall distribution.
- Irrigation facilities are the sole way to meet various crop water requirements.
- Because it is a tropical country, the high temperature and evaporation rise quickly.
- As a result, artificial irrigation is required for a plentiful supply of water.

REQUIRED COMPONENT

System Requirements:

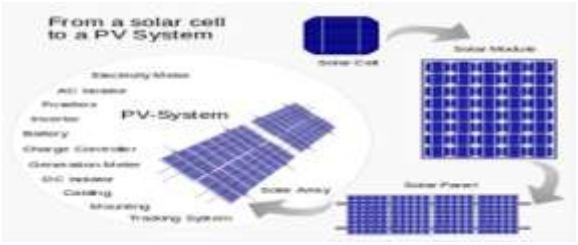
- Microcontroller from the 8051 series
- Operational amplifier
- Display (LCD)
- Relay
- Pump for water
- A voltage regulator is a device that regulates the voltage in a circuit.
- Diodes are a type of semiconductor.
- Capacitors
- The use of resistors
- Crystallized LEDs
- Transistor is a type of semiconductor.

Requirements for software:

- The C++ programming language

Solar panel (PV-cell)

Solar panels transform light-based solar energy into electricity. Solar panels can be used to power a range of items, including personal electronics, electrical equipment, and car batteries. A solar cell, often known as a photovoltaic (PV) cell, is a nonmechanical device that transforms sunlight directly into energy. Artificial light can be converted to power by some PV cells.



Power supply board:

It connects a system's negative and positive terminals to three power sources: a solar panel, a battery, and the main power source (adopter). Although the battery will not charge when using the adaptor, the solar panel is linked to it for charging purposes. As a result, diodes are used to make connections, preventing charge backflow while simultaneously switching the system.

Electric Battery:

An Electric battery is a device that, through an electrochemical oxidation-reduction (redox) cycle, turns biochemical stored energy within its active components directly into electric energy. Electrons are passed from one material to another via an electric circuit in this type of reaction.

Microcontroller:

Heart of the automation system is a microcontroller, which is utilised to control all vital processes. The status of the soil as sensed by the sensor is communicated to the microcontroller as a binary number between 0 and 1. The sensor will send 1 if the soil is dry and 0 if the soil is damp, depending on the sensor utilised.The controller, combined with the LCD display and GSM module, will transmit a signal to the relay drive based on the soil status. The microcontroller utilised here is W78E052, which belongs to the 8051 family. The microcontroller is mounted on the controller board, which also houses the power supply and other connections.

Moisture Sensor for the Soil:

In considerations of sensitivity, a moisture in the soil sensor measures the soil resistance or cubic water content. Whenever an object is placed in the fields, its measures the level of moisture or water present. Whenever the water content in the soils is high, it generates a dc signal of 5 volts, and then when the water[MOISTURE] level is low, it generates a digital output of zero volts

G.S.M Unit:

It is a system that connects the server and the nodes via wireless communication. GSM, in other words, allows two systems to communicate within a certain range. One can learn about the state of the activity without having to go to the location. The GSM SIM800c module is utilised here, and It operates on the 900 / 1800 Mhz frequency band. A 5V microcontroller is linked to the module, which delivers instructions and transfers data across systems. From the registered mobile phone number, the system can send SMS instructions to the automated system. In this project, the G.S.M sends an message on the condioning status of the P.U.M.P

Display (L.C.D):

L.C.D. (Liquid.Crystal.Display) screens are electronic screen modules that can be used in a wide range of applications. A 16 * 2 L.C.D display is a straightforward component that can be found in a variety of devices and circuits. The status of the soil, such as whether it is full of water, and the status of the pump, such as whether it is open or closed, are both displayed here.

Pumping device :

A PUMP is a mechanically operated device that moves water. Pumps use energy to produce mechanical work by moving fluid and are powered by some mechanism. Pumps can be powered by physical labor, electricity, engines, or windfarms, and they range in size from microscopic medical pumps to huge industrial pumps.Well water pumping, irrigation, fuel pumping, and cooling tower operating are among functions that mechanical pumps are utilised for. Irrigation pumps are centrifugal electrical pumps that self-prime.

SYSTEM DESCRIPTION

Farmers must measure soil moisture in order to control their irrigation systems in agriculture. Using a soil moisture metre is one option. The amount of water in a container is determined by this sensor. A soil water sensor's capacitance is being used to measure the water in the soil. This sensor is easy to operate. Simply insert this rugged sensor into the soil to also be examined, and the water content capacity of the soil will be expressed in percent.

OPERATIONS

This system is based on a fundamental principle. The soil moisture sensor monitors the condition and compares it to the potentiometer's set value when it is installed in the field. The soil is considered dry if the value is less than zero, and a signal is transmitted to the microcontroller. The relay drive is instructed by the microcontroller to terminate the circuits and power on the waterpump. The microcontroller will also command the Cellular model to deliver a Message to the registered SIMcard notifying users of the pump's status. The microcontroller sends the signal it to relay to open the circuit and switch off the pump if the value of the potentiometer crosses the predetermined value. The Cellular module then sends a second Send message to the SIM, alerting it of the status of the pump. At the same time, the soil state will be presented on the LCD. The automated system is now operational as a result of this. The pump can also be operated by a switch in the event of an automatic system failure, although this needs a trip to the field to turn on the switch. The switch must be turned off once more after the watering is finished.. Aside from irrigating the area, the pump can also be utilised for other purposes by manually switching it on and off.

CODE OF OPERATION

```
#include<bits/stdc++.h>

#include <unistd.h>

using namespace std;

double generate_random_value(double threshold){

// generates something in range [0,2*threshold]

return abs(2*rand()/(double)RAND_MAX)*threshold;

}

class Config{


public:

static double potentiometer_threshold_value;

static double rate_of_moisture_addition;

/**

* Method to load config

**/
```

```
static void load_config(){
cout<<"INFO: Enter the potentiometer threshold value for soil moisture sensor....\n";
cin>>Config::potentiometer_threshold_value;
cout<<"INFO: Enter the rate at which moisture in soil is getting added....\n";
cin>>Config::rate_of_moisture_addition;
}
static double get_potentiometer_threshold_value(){
return potentiometer_threshold_value;
}
static double get_rate_of_moisture_addition(){
return rate_of_moisture_addition;
}
};
class SoilMoistureSensor{
double value;
public:
void fetchValue(){
// Currently we are fetching the values from standard input
cout<<"INFO: Fetching soil moisture value....\n";
// Mocking the soil moisture sensor
value=generate_random_value(Config::get_potentiometer_threshold_value());
cout<<"INFO: Got value:: "<<value<<endl;
}
void updateValue(double rate_of_moisture_addition){
value+=0.2; // assuming that
}
double getVal(){
return value;
}
};
class WaterPump{
int state; // 0 for off and 1 for on
public:
```

```
WaterPump(){
this->state=0; // initialize the state to OFF
}
void toggle_pump(){
state=1-state;
}
};
class Display{
public:
static void log_message(string message){
cout<<"============== LCD Display ==============\n";
cout<<message<<"\n";
cout<<"=========================================\n";
}
};
class GSMModule{
public:
static void send_sms(string message, string ph_number){
cout<<"INFO: Sending message from GSM Module...\n";
// Mocking the send sms operation
cout<<"INFO: Message sent successfully!\n";
}
};
double Config::potentiometer_threshold_value=0;
double Config::rate_of_moisture_addition=0;
int main(){
cout<<"INFO: Loading config...\n";
Config::load_config();
while(1){
cout<<"INFO: System started....\n";
auto soil_moisture_driver=SoilMoistureSensor();
soil_moisture_driver.fetchValue();
if(soil_moisture_driver.getVal() < Config::get_potentiometer_threshold_value()){
```

```
// Soil is DRY
cout<<"INFO: Soil is DRY... Starting the Water Pump...\n";
auto pump=WaterPump();
pump.toggle_pump();
Display::log_message("Water Pump started successfully!");
while(soil_moisture_driver.getVal() < Config::get_potentiometer_threshold_value()){
cout<<"INFO: Soil is still DRY... Current Moisture Level: "<<soil_moisture_driver.getVal()<<"; \n";
soil_moisture_driver.updateValue(Config::get_rate_of_moisture_addition());
usleep(1000000);
}
// turn off the water pump
pump.toggle_pump();
Display::log_message("Water Pump stopped successfully, as moisture levels are now ok!");
}else{
// Soil is OK
cout<<"INFO: Soil is OK...\n";
}
cout<<"INFO: System sleeping for 10 seconds....\n";
cout<<"<<<<<---------------------------------->>>>>\n\n";
usleep(10000000);
}   return 0;}
```

ADVANTAGES:

In terms of physical components and power usage, the system is affordable. The system aids in water and electricity conservation. It has the potential to be used in broad agricultural areas When no workers are available, the strategy aids in the resolution of problems and eliminates personnel. The system can be switched to manual mode if necessary. It can be used in a variety of irrigation and environmental conditions...

APPLICATIONS:

Fields, gardens, and farms can all stand to profit from irrigation. It works on a wide range of crops. This app can be used to keep track of your patients. This system's software program can be implemented for household tasks like tank storage. This mechanism can be operated manually or automatically.

Cost of Component:

Products used	Price (in Rs.)
Solar Panel	(Subsidized from govt.)
Battery	450
LCD	200
Microcontroller	200
Motor	80
Voltage Regulator	5
Soil Sensor	150
Capacitor	5
LED	5
Relay	10
Transistor	2
Crystal	2
Resistor	2

TOTAL: 1,111 Rs.

FUTURE SCOPE

Irrigation can be done in a variety of settings, including fields, gardens, and farms. It can be used on a variety of crops. It is possible to utilize this technique to keep track of patients. In this system programming can be applied for residential purposes, like as water storage. This device could be manually or completely automated.

CONCLUSION

Farmers and gardeners who haven't a huge amount of time to watering respective crops/plants will benefit the most from this project. Farmers who use too much water to grow their crops are also protected.. This project could be extended to greenhouses where manual control is uncommon. Fully automated gardens and farmlands can benefit from the technology. It has the ability to save a lot of water when utilised in conjunction with the rainwater collection method. With most types of soil and in agricultural settings with considerable rainfall deficiencies, this practice can be effectively utilised to generate exceptional results. As a result, using renewable sources of energy like wind or solar can help to create a pollution-free society.

REFERENCE:

- www.wikipidea.com
- The 8051 Microcontroller and Embedded Systems Using Assembly and C - Muhammad Ali Mazidi
- Smajstrla, A.G.; Locascio, S.J. 1996. Tensiometer- controlled drip irrigation scheduling of tomato.
- https://docplayer.net/159467779-Agri-voltaic-system-experiences-with-water-harvesting-systems.html
- https://www.explainthatstuff.com/how-inverters-work.html
- https://www.cleanenergyreviews.info/blog/2014/5/4/how-solar-works
- https://www.startsolar.com.au/how-solar-system-works/