AUTOMATED IRRIGATION SYSTEM BASED ON SOLAR POWER

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Abstract:

Solar power has risen as achievable wellspring of sustainable power source in the course of recent decades and now utilized for different applications. This paper proposes a solar powered automatic irrigation system. The main objective of this model is to plan a minimal effort and reliable water system with the assistance of microcontroller. By utilizing this system an agriculturist can produce crops in proficient way. There is no convincing reason to consistently monitor the soil and climate condition for development of harvests. Solar based power is utilized to supply expected power to the entire system. Moisture sensor is introduced in field which detects the soil moisture and signs the pump to begin or stop. This system includes two different modes – Automatic mode and Manual mode through GSM. Automatic mode depends on soil moisture sensor and Manual mode depends on DTMF Decoder.

Keywords – Automatic irrigation system, Solar power, Moisture sensor, GSM, Microcontroller, DTMF Decoder.

I. Introduction

Indian economy is one of the biggest creating economies of the worlds committing its biggest rural parts. To accomplish most extreme usage of labour and to acquire greatest benefit in a given stipulated there is a need in the up-degree of different designing procedures that are being utilized today. In this manner keeping up appropriate measure of water level in the soil is one of the essential pre-requisites to harvest a decent product that can be a wellspring of different sorts of supplements whether smaller scale or full scale for their reasonable development. On the off chance that we discuss Indian farmers are most noticeably bad hit by the starvations that happens because of disappointment of yields relying on different dry spell factors. Rain assumes the key part in choosing the eventual fate of these yields and the farmers consistently. The over usage of ground water has definitely diminished the ground water level over the most recent 15 years. So there is have to use every last drop of water admirably. With the goal that it can likewise be utilized by our coming ages moreover. We ought to build up some new techniques that utilization the inexhaustible wellsprings of vitality. The advancement of these new procedures will achieve our

objective of practical improvement and in addition to remove the discharge of ozone depleting substances to a base level. As the name of my project that is "AUTOMATIC IRRIGATION SYSTEM" with the help of the SOLAR POWER is a step to utilize some new engineering techniques. This strategy will be a decent choice for the little and medium farmers who suffer each year in light of disappointment of products that occurred each year. The usage of this innovation has a wide extension in the adjacent future.

The primary goal of this project was to outline a little scale model that would utilize water in more efficient way with a specific purpose to neutralize abundance water adversity and limit the cost of work.

The following aspects were considered in the selection of aforesaid solution -

- Installation cost
- Water saving
- Human intercession
- Reliability
- Power consumption
- Maintenance
- Expandability

II. Proposed Model

The proposed system is automated irrigation system based on solar power. This system includes two different modes:

i. Automatic mode
ii. Manual mode through GSM

In this system the pump will automatically ON or OFF the water supply to the field when the moisture sensor signals it. Moisture sensor is installed in the field which senses the soil moisture and accordingly signals the pump to start or stop.

Since different plants need different quantity of water for its proper growth. By using moisture sensor system can only irrigate the field but it cannot sense how much water is needed for a particular plant. Here we use DTMF Decoder, which can be used by farmer to watering the plant as per plant requirement. DTMF Decoder is connected to a phone which is set in auto answering mode. So, when farmer finds that in certain area water is needed or flooded, he can simply operate the motor as per need through his phone by a call. Toggle switch is used to operate between Automatic mode and GSM mode.

By using LDR the solar panel will track the sun throughout the day. This will increase the efficiency of solar cell. With solar power we can also control the lights of field according to our requirement at night which will be beneficial for the farmer.

III. Description of the components

A. Solar panel

B. Battery

C. Moisture sensor

D. Micro controller (ATmega16)

E. DTMF Decoder

F. Relay

G. DC Gear motor

H. Submersible pump

I. Motor Driver

A. Solar panel: Photovoltaic modules are also called solar modules which are used to convert sunlight to the electricity. Solar modules are just like an integrated circuit like an electronic component, the most commonly material used in solar panel is silicon crystal. We know that the photos are strikes on the silicon crystal then the electricity can be generated (dc supply). The rating of a solar panel is 6 volts and 6 watts.

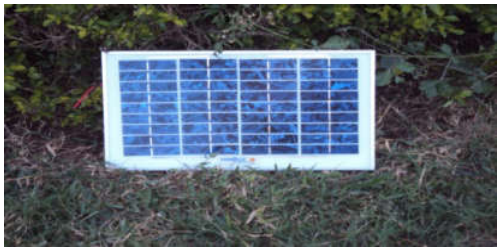


Fig: 1 solar panel

B. Battery: Lead acid battery is used, the rating of the battery 4 V and 1.5 Ah. The main purpose of the battery is to store the dc supply. (From solar panels).

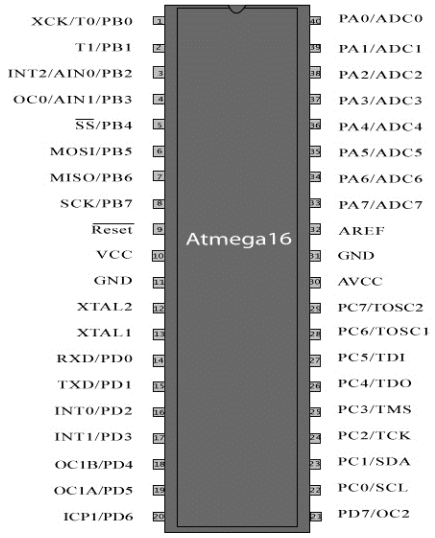
Fig: 2 Battery

C. Moisture sensor: Soil moisture sensors measure the volumetric water content in soil. Soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated

and maybe varying depending on environmental factors such as soil type, temperature, or electric conductivity.

Fig; 3 Moisture sensor

D. Microcontroller: ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz. ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively. ATmega16 is a 40 pin microcontroller. There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD. ATmega16 has various in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals.



E. DTMF Decoder: This circuit detects the dial tone from a telephone line and decodes the keypad pressed on the remote telephone. The dial tone which will be heard in the phone set is called Dual Tone Multi-Frequency, DTMF in short. The name was given because the tone that we heard over the phone is actually making up of two distinct frequency tones, hence the name dual tone. The DTMF tone is a form of one way communication between the dialer and the telephone exchange. A complete communication consists of the tone generator and the tone decoder. In this article, we are using the IC MT8870DE, the main component to

decode the input dial tone to 5 digital outputs. This paper deals only with using last digital bit for operate water pump i.e. 0 and 1. (1 for start the pump, 0 for stop the pump)

Keypad Dial Tone Frequency Table:

	1209 Hz	1336 Hz	1477Hz
697 Hz	1	2	3
770 Hz	4	5	6
852 Hz	7	8	9
941 Hz	*	0	#

F. Relay: Relay is a electrically controlled switch for on and off .Here, the purpose is turn on and off a motor based up a sensors signals. If the land is dry condition the humidity sensors give the signal to micro controller and the micro controller gives signals to relay for turn on the motor similarly in the wet conditions the relay automatically off.

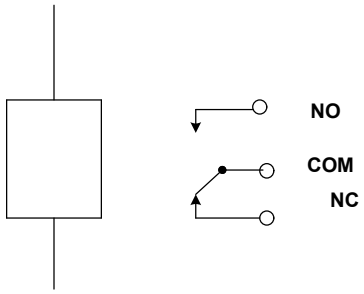
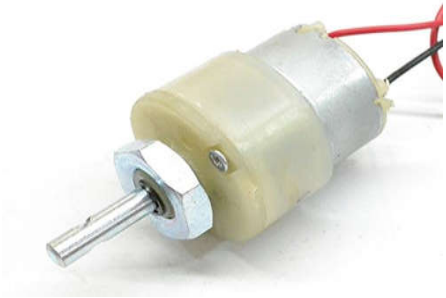


Fig: 4 Relay

G. DC Gear Motor: A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. In a geared DC motor, the gear connecting the motor and the gear head is quite small, hence it transfers more speed to the larger teeth part of the gear head and makes it rotate. The larger part of the gear further turns the smaller duplex part. The small duplex part receives the torque but not the speed from its predecessor which it transfers to larger part of other gear and so on. The third gear's duplex part has more teeth than others and hence it transfers more torque to the gear that is connected to the shaft. DC Gear motor is used for solar tracking. LDR gives the signal to microcontroller, and then microcontroller controls the motor through motor driver according the signals. We are using 1000RPM 12V DC motor.



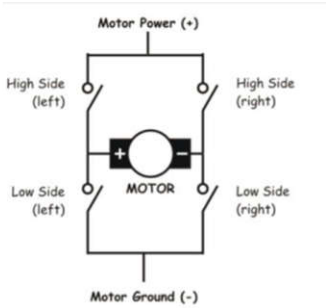
Fig; 5 DC Gear motor

H. **Submersible pump:** A submersible pump is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitations, a problem associated with a high elevation difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps. Electric submersible pumps are multistage centrifugal pumps operating in a vertical position. Liquids, accelerated by the impeller, lose their kinetic energy in the diffuser where a conversion of kinetic to pressure energy takes place. This is the main operational mechanism of radial and mixed flow pumps. Fluids enter the pump through an intake screen and are lifted by the pump stages. We are using 3V-6V DC, 0.4W-1.5W pump for project.

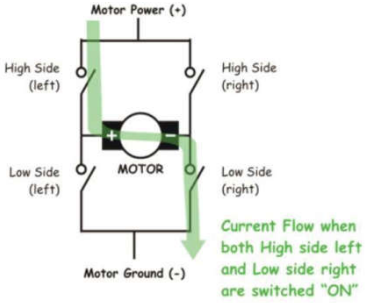
Fig; 6 Submersible pump

I. **Motor driver:** Whenever we are talking about driving a motor through the outputs of our microcontroller, it is not easy to do that work. This is so because our motors specification tells to drive it on 12v dc but our microcontroller can give a max of 5v. So to drive a motor we need some drivers which can amplify the 5v voltage to 12v. . These days many IC manufacturers have H-bridge motor driver available in the market like L293D is most used H- Bridge driver IC. The driver which we are using here to drive the motor is an IC L293D. The name "H-Bridge" is derived from the actual shape of the switching circuit which

controls the motion of the motor. It is also known as "Full Bridge". Basically there are four switching elements in the H-Bridge as shown in the figure below:



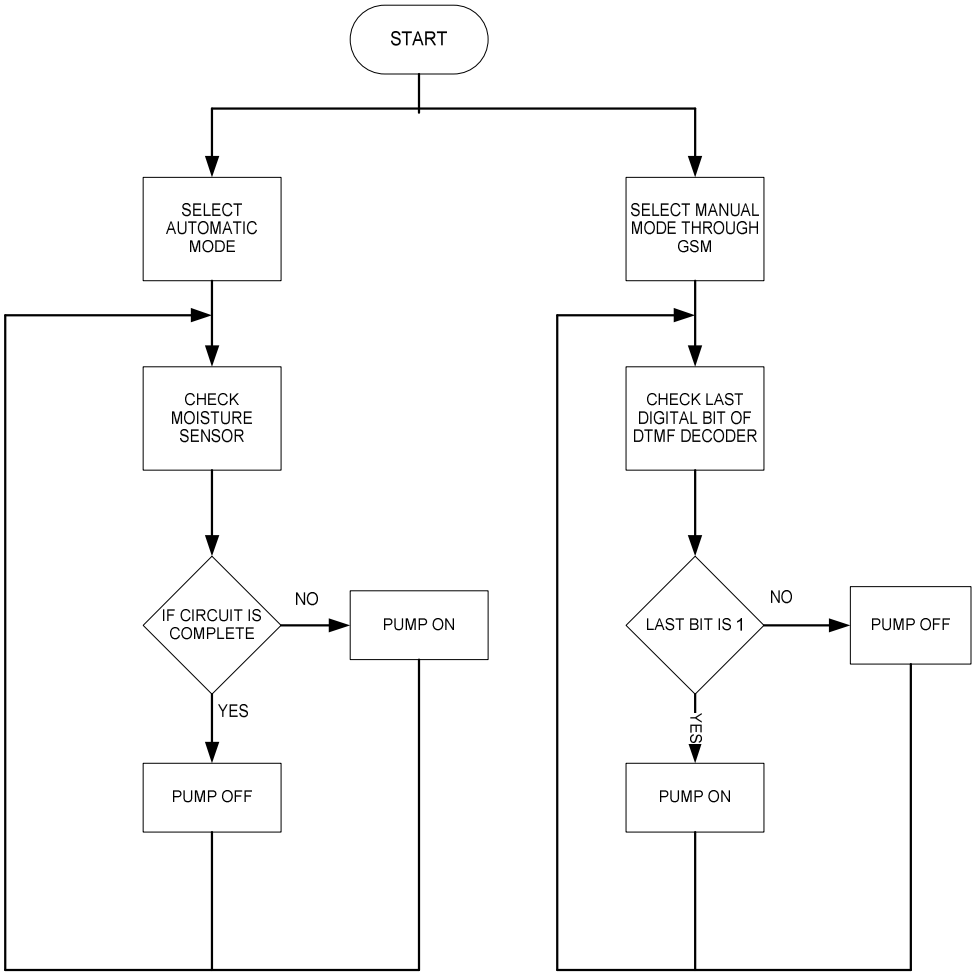
There are four switching elements named as "High side left", "High side right", "Low side right", "Low side left". When these switches are turned on in pairs motor changes its direction accordingly. Like, if we switch on High side left and Low side right then motor rotate in forward direction, as current flows from power supply through the motor coil goes to ground via switch low side right. This is shown in the figure below -



Similarly, when we switch on low side left and high side right, the current flows in opposite direction and motor rotates in backward direction. This is the basic working of H-Bridge. We can also make a small truth table according to the switching of H-Bridge explained above.

Truth Table				
High Left	**High Right**	**Low Left**	**Low Right**	**Description**
On	Off	Off	On	Motor runs clockwise
Off	On	On	Off	Motor runs anti-clockwise
On	On	Off	Off	Motor stops or decelerates
Off	Off	On	On	Motor stops or decelerates

IV. Flowchart of proposed system



V. Conclusion

A proper model of automated irrigation system was outlined and actualized model was thought about minimal effort, unwavering quality, and exchange wellspring of electric power and programmed control. As the proposed display is consequently controlled it will push the agriculturists to reasonably inundate their fields. The model dependably guarantees the adequate level of water in the paddy field dodging the under-water system and over-water system. Farmers can remotely ON/OFF the engine by utilizing mobile phone even from away. Sun oriented power gives adequate measure of capacity to drive the system. To conquer the need of power and facilitate the water system framework for our agriculturists, the propose model can be an appropriate option.

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