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" A STUDY ON SOLAR OPERATED DESALINATION CONTROL WATER PUMP WITH REMOTE CONTROL TECHNOLOGY "

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ABSTRACT

The main aim of this thesis is to design a solar powered water pump with desalination and remote control technology that can provide water for irrigation without the use of generators or power grid. I have designed the system such that necessary power can be obtained from panel arrangement to run the submersible pump which pumps water from underground. I have calculated different tilt angles to provide the energy necessary to pump water for the cultivation and crops to grow on. The system is designed to fulfill the water required for the irrigation of crops with adequate pH level for cultivation and desalination control to remove salt from Agriculture farm. It also has a remote operating system so that owner can operate farm irrigation from anywhere in the world . PV solar electricity has proven to be a reliable source of energy in the rural areas which are far from the national or main grid. It is a perfect way of promoting development activities and creating opportunities for the rural area dwellers. The people's livelihood have been transformed in terms of lighting their homesteads, creating opportunities such as employment for the and enabling them to live the way they would like to live instead of relying in limited options.

Keyword: *Design, solar, pH level, crops, power grid*

I. INTRODUCTION

India is an agricultural country. About 70% of the people depends on agriculture. It plays a main role in developing a country. Agriculture acts as an important aspect in India's economy .

The history of Agriculture in India dates back to Indus Valley Civilization and even before that in some places of Southern India.[1] India ranks second worldwide in farm outputs. As per 2018, agriculture employed 50% of the Indian work force and contributed 17-18% to country's GDP.[2]

In 2016, agriculture and allied sectors like animal husbandry, forestry and fisheries accounted for 15.4% of the GDP (gross domestic product) with about 31% of the workforce in 2014.[3][4][5] India ranks first in the world with highest net cropped area followed by US and China.[6] The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India.

India exported $38 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide and the sixth largest net exporter.[7] Most of its agriculture exports serve developing and least developed nations.[7] Indian agricultural/horticultural and processed foods are exported to more than 120 countries, primarily to the Japan, Southeast Asia, SAARC countries, the European Union and the United States.[8][9]

As per the 2014 FAO world agriculture statistics India is the world's largest producer of many fresh fruits like banana, mango, guava, papaya, lemon and vegetables like chickpea, okra and milk, major spices like chili pepper, ginger,

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fibrous crops such as jute, staples such as millets and castor oil seed. India is the second largest producer of wheat and rice, the world's major food staples.[10]

India is currently the world's second largest producer of several dry fruits, agriculture-based textile raw materials, roots and tuber crops, pulses, farmed fish, eggs, coconut, sugarcane and numerous vegetables. India is ranked under the world's five largest producers of over 80% of agricultural produce items, including many cash crops such as coffee and cotton, in 2010.[10] India is one of the world's five largest producers of livestock and poultry meat, with one of the fastest growth rates, as of 2011.[11]

One report from 2008 claimed that India's population is growing faster than its ability to produce rice and wheat.[12] While other recent studies claim that India can easily feed its growing population, plus produce wheat and rice for global exports, if it can reduce food staple spoilage/wastage, improve its infrastructure and raise its farm productivity like those achieved by other developing countries such as Brazil and China.[13][14]

In fiscal year ending June 2011, with a normal monsoon season, Indian agriculture accomplished an all-time record production of 85.9 million tonnes of wheat, a 6.4% increase from a year earlier. Rice output in India hit a new record at 95.3 million tonnes, a 7% increase from the year earlier.[15] Lentils and many other food staples production also increased year over year. Indian farmers, thus produced about 71 kilograms of wheat and 80 kilograms of rice for every member of Indian population in 2011. The per capita supply of rice every year in India is now higher than the per capita consumption of rice every year in Japan.[16]

India exported $39 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide, and the sixth largest net exporter.[7] This represents explosive growth, as in 2004 net exports were about $5 billion.[7] India is the fastest growing exporter of agricultural products over a 10-year period, its $39 billion of net export is more than double the combined exports of the European Union (EU-28).[7] It has become one of the world's largest supplier of rice, cotton, sugar and wheat. India exported around 2 million metric tonnes of wheat and 2.1 million metric tonnes of rice in 2011 to Africa, Nepal, Bangladesh and other regions around the world.[15]

Aquaculture and catch fishery is amongst the fastest growing industries in India. Between 1990 and 2010, the Indian fish capture harvest doubled, while aquaculture harvest tripled. In 2008, India was the world's sixth largest producer of marine and freshwater capture fisheries and the second largest aquaculture farmed fish producer. India exported 600,000 metric tonnes of fish products to nearly half of the world's countries.[17][18][19] Though the available nutritional standard is 100% of the requirement, India lags far behind in terms of quality protein intake at 20% which is to be tackled by making available protein rich food products such as eggs, meat, fish, chicken etc. at affordable prices[20]

India has shown a steady average nationwide annual increase in the kilograms produced per hectare for some agricultural items, over the last 60 years. These gains have come mainly from India's green revolution, improving road and power generation infrastructure, knowledge of gains and reforms.[21] Despite these recent accomplishments, agriculture has the potential for major productivity and total output gains, because crop yields in India are still just 30% to 60% of the best sustainable crop yields achievable in the farms of developed and other developing countries.[22] Additionally, post harvest losses due to poor infrastructure and unorganised retail, caused India to experience some of the highest food losses in the world.[23][24]

Indian irrigation infrastructure includes a network of major and minor canals from rivers, groundwater well-based systems, tanks, and other rainwater harvesting projects for agricultural activities. Of these, the groundwater system is the largest. Of the 160 million hectares of cultivated land in India, about 39 million hectare can be irrigated by groundwater wells and an additional 22 million hectares by irrigation canals. In 2010, only about 35% of agricultural land in India was reliably irrigated. About 2/3rd cultivated land in India is dependent on monsoons. The improvements in irrigation infrastructure in the last 50 years have helped India improve food security, reduce dependence on monsoons, improve agricultural productivity and create rural job opportunities. Dams used for irrigation projects have helped provide drinking water to a growing rural population, control flood and prevent drought-related damage to agriculture. However, free electricity and attractive minimum support price for water intensive crops such as sugarcane and rice have encouraged ground water mining leading to groundwater depletion and poor water quality. A news report in 2019 states that more than 60% of the water available for farming in India is consumed by rice and sugar, two crops that occupy 24% of the cultivable area.Moreover, water has been an aid for farmers as quality of crops and yield gets damaged without proper water for a day.

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Although India has attained self-sufficiency in food staples, the productivity of its farms is below that of Brazil, the United States, France and other nations. Indian wheat farms, for example, produce about a third of the wheat per hectare per year compared to farms in France. Rice productivity in India was less than half that of China. Other staples productivity in India is similarly low. Indian total factor productivity growth remains below 2% per annum; in contrast, China's total factor productivity growths is about 6% per annum, even though China also has smallholding farmers. Several studies suggest India could eradicate its hunger and malnutrition and be a major source of food for the world by achieving productivity comparable with other countries

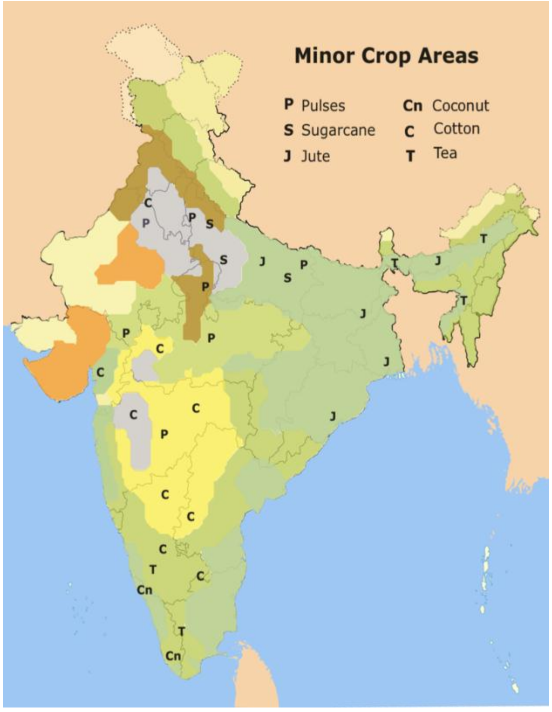

Fig.1 India map minor crop area

II. RESEARCH OBJECTIVE

In this report we will take an attempt to design a feasible automatic solar powered water pump with a detachable desalination/ ph level control / fertilisation tank to meet this need espically for mechanised farms or poly houses and to claim government insurance policies in better way to meet full food requirement of country in drought seasons .
Solar energy possesses a huge potential for solar irrigation and can be used to pump water for livestock and crops. We need to design or renovate buildings to trap the heat available in daylight. The trapped heat can also be used to warm homes and livestock yards.
Some livestock need a continuous supply of fresh air. We can design systems to run coolers and other such boxes and avoid electricity bills. The most cost-effective approach is to ask your builder to design the structure of building in such a way that it effectively optimizes the sunlight it receives.
Solar water heaters can provide hot water for cattle cleaning and pen cleaning. Dairy operations can use hot solar water to warm and stimulate cow’s udders. The sunlight can be used to generate electricity to power homes and agriculture houses.

2.1 GSM Module

The system sets the irrigation time depending on the temperature and humidity reading from sensors and type of crop and can automatically irrigate the field when unattended. Information is exchanged between far end and designed system via SMS on GSM network. A Bluetooth module is also interfaced with the main microcontroller chip which eliminates the SMS charges when the user is within the limited range of few meters to the designated system. The

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system informs users about many conditions like status of electricity, dry running motor, increased temperature, water content in soil and smoke via SMS on GSM network or by Bluetooth. The GSM based pump control system may offer users the flexibility to regulate and control the operations of their irrigation systems with little intervention to reduce runoff from over watering for improvement in crop yield. This enables users to take advantage of the globally deployed GSM networks with its low SMS service cost to use mobile phones and simple SMS commands to manage th eir irrigation system.

2.2.1 GSM module:

Fig.2.1 Finally the status of motor is also seat to the user

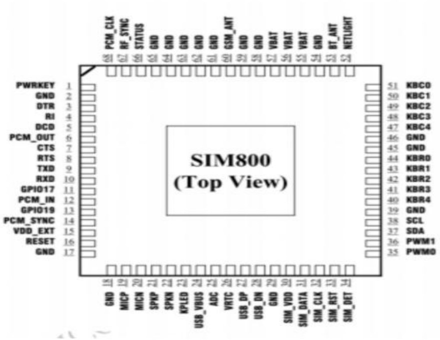

Fig.2.2 Pin out diagram of GSM SIM 800

III. RESULTS AND DATA

The cultivation timing of our locations are based of two time periods September to November and February to April. With the help of MATLAB, for each of these time period we have calculated their individual intensities (I), energies (E), flow rates and hence the total water obtained is calculated. As discussed earlier, the minimum total water required is 2,20,959.6 litres and we have designed the solar panel system such that this requirement is fulfilled.

Calculation for optimized tilt angle

Optimized tilt angles (λ)

Tilt angles calculated:
Tilt angle optimized for latitude (λ1) = 24.04°
Tilt angle optimized for Sep-Nov (λ2) = 35.8427°
Tilt angle optimized for Feb-Apr (λ3) = 25.5002°
Tilt angle optimized for Sep-Apr (λ4) = 33.6864°
Tilt angle optimized for Dec (λ5) = 47.1943°

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3.1 Advantages of Wireless Pump Controller

User can operate pump/motor from anywhere, from any distance. User can operate pump via SMS as well as just MISS CALL GSM Technology, Reliable operation, Worldwide ConnectivityLow Cost, Quality and less maintenance and robust device.Storing Master No Thru SMS

SMS To Get The Status of device. Missed Call To Control - Motor On and Off Message Alerts for Power UP , Motor On, Motor Off , Status.

IV. CALCULATIONS

4.1 Solar Panel

Availability : 250 watt hour
350 watt hour
450 watt hour

4.2 Power Requirements

S.No.	APPLIANCE	POWER CONSUMPTION
1	AC/DC Inverter	50-70 watt-hour
2	GSM Module	50-70 watt-hour
3	Pump	Based on Pump Size 1HP = 745. 7 watt (1hp 450-750 watt-hour) Shakti 1hp 70 watt-hour submersible pump
4	Battery	12v , 150 Ah = 1800 watt-hour 24v , 150Ah = 3200 watt-hour

4.3 Solar Panel

Pmax = Max Power = 50,100,150,250,350 (watt)
Voc = Open circuit voltage = 21v, 40v
Isc = Short circuit current = amp
Sunshine = 10 hours (6 hours max power)
POWER (Watt) = Potential difference
(Volts, V) x Current (I)
Watt = Volts x Ampere
Volts = For AC supply 230 v, For DC supply 12v , 24 v
Number of solar panel required = Power Requirement ÷ Panel Power output
(Pump, Battery, Inverter, Gsm Module, Other requirements) 50, 100, 150, 250, 350 (Watt)

4.4 Battery

Battery = 12v , 24v 50, 100, 150 (Ah)
Power = Volts x Current
Watt = Volts x Ampere
Battery Power Capacity Watt = Volts (12 , 24) x Ampere (50 , 100 , 150)
Recharge time = Battery Size watt ÷ Sunshine (Solar 6-8 hour / day)

4.5 Battery backup

= Battery Capacity watt { 12v x (50, 100, 150) Ampere ah } * number of battery
Battery Drain Time (hours)
= Battery Capacity (watt) ÷ Load (watt)

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4.6 Pump

POWER (watt) = Volts (v) * Current (Amp)
1hp = 745.7 watt (shakti 1hp = 70 watt new)
1 KWh = 1.341 hp

APPLICATIONS

1) This small scale project can be implemented in many houses, buildings and industries with minimum cost and resources.
2) This system is useful for farmers in water irrigation and on/off pump from any place.

ADVANTAGES

1) The implemented overall system is user friendly.
2) Time required for working of system is less.
3) The system is designed to avoid and control wastage of water.
4) The system implemented to reduce manpower.

BENEFITS OBTAINED

Solar irrigation can increase incomes dramatically, particularly for remote producers with inconsistent access to electricity or fuel.

Pump irrigation reduces labor for water delivery.

By targeting water at a crop's roots, drip irrigation can reduce weed and disease pressures, and increase efficiency of chemical applications.

Drip irrigation significantly increases water use efficiency.

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