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Portable Ground Based Solar Energy Mapping System

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Abstract: To cope the electric power crises, the trend of power production is move towards the renewable energy worldwide. Pakistan's power demand is increasing fast due to eruption of populations and more usage of technological means. That's why, it is more important to go for cost-effective and reliable renewable energy resources for power raising. Solar energy is a gifted and freely available source among the renewable energy resources to fulfill the increasing energy demands of common populace. Pakistan's geographic positions and typical weather offers high potential renewable resources to produce solar energy for coping the current energy crises. The arduino based micro solar energy system proposed in this paper describes the method and technique aim to help solar energy production in micro level. The micro based solar energy system is portable system which can be install at different places for different purposes as we can identify the solar energy potentials of different areas and secondly we can generate solar energy on micro level to fulfill the domestic energy requirements as discussed in this article.

Keywords: Arduino Microcontroller, Prototype System, Solar Energy Controller, Solar Panel

1. INTRODUCTION

The expansion of solar energy propensity needs a wide range of solar means. From the last years the different countries has been paid consideration to produce economical viable solar thermal energy and add it to the electrical system to overcome the energy deficits (Alyahya, and Irfan. 2016), The main aim of solar energy is to improving the energy production by exploiting the solar resources and reducing the capital cost of the system (Buonomano, *et al.,* 2016). In the initial era, the usage of solar energy and deployments technology was been inadequate and produced limited profitability due to high capital cost of the system. In recent years, the significant reduction of the high costs of solar energy collectors and photo-voltaic solar panels and sustainable renewable energy policies, different countries preferred to adopt and promoting the micro-level solar system (Calise, *et al.,* 2017): In European Countries, the aim of promoting solar energy is to adoptions of solar energy collectors and photo-voltaic system to enhance the renewable energy resources utilization (Calise, (2017):.Moreover, among the resources of renewable energy, the solar energy sources is quickly becoming suitable due to vast, sanitary and dependable(Georgiou, and Skarlatos. 2016). The solar energy is become more effective since the energy conversion productivity of photo-voltaic solar cells (Potić,*et al.,* 2016).In the past few years, the trend is move to utilization and production of solar energy Because of affordable investments despite the sizes of solar panels as shown in **(Fig 1) (**Luković, 2015). The secure quantity of energy distribution is considered more important and necessity for the development of country. However, in current era, the economic situations of many countries demand to usage of renewable energy particular in solar energy and overcome the negative impact from the environment and others issues related with fossil fuels power generations.

Many countries of world, have focused on production of environment friendly and alternate energy resource for power generation (Georgiou, *et al.,* 2012). Which are renewable sources in order to endure the cumulative power supply-demand.

The solar energy is apparently naturally beneficial comparative to other non-renewable energy resource and the prerequisite of maintainable expansion energy production program (Doljak, and Stanojević. 2017). the solar energy can be generated by the solar thermal and photo-voltaic cells for different submissions. The benefits of solar energy are, do not emission of green-house toxic-gasses, recovery of despoiled land, decrease of transmission power-lines from electric power stations, and growth of national power liberation (Szabó, 2017). Moreover, the solar energy deliver variation and safety of the power distribution accelerated the electric power system in rustic areas of country (Hafeznia, *et al.* ,2016).

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Fig 1.Micro Level Solar Energy Usage

2. SYSTEM DESIGN IN PROTEUS

The arduino based micro solar energy system has been develop to providing the facilities to those user which are not connect to regional and national power grid or living in the remote and rustic areas of the country. The prototype system consist with arduino micro controller, solar panel, solar energy collector, battery and display contrast controller system. Before designing the hardware prototype module the system has been simulated in proteus environment to identify the hardware components as shown in **(Fig.2)**.

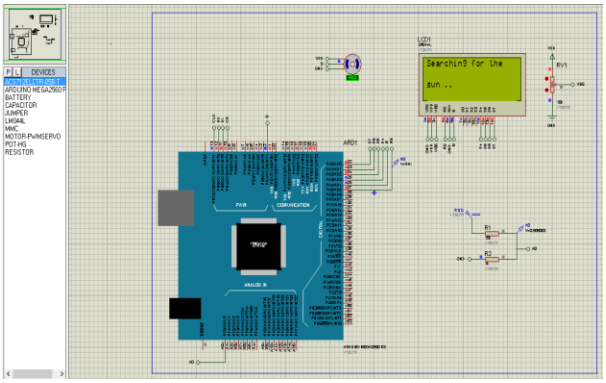

Fig 2. Micro Energy System in Proteus Simulation

2.1 Arduino Microcontroller

It is a component of micro energy system which provide interface to connect the various components system (Hussain, 2017). The all modules of system are connected via different input/output ports of embedded arduino board system. The main objective of usage of arduino board is to control the whole activities of system architecture (Zahoor *et al.*,2017).

2.2 Display Contrast Controller

Display contrast controller included liquid crystal display panel and backlight system. It is used for display result (Zahoor 2016). It is consist with light emitting diode and gas plasma technologies (Zahoor, 2016): (Raza *et al.*,2016):

2.3 Solar Energy Collector

The solar energy collector is used to specify the direction of solar panel where the collector received maximum power from the solar. It continuously rotated on 180 degree direction to select the best one direction for maximum power.

2.4 Solar Panel

The panel is used to obtain energy from the solar and send it to the system. The solar panel comes with different size. In our research we have used 4x4 solar panel to generate the solar energy for the portable devices as mobile devices, laptop and battery bank etc.

3. SIMULATION RESULTS

Before designing the hardware the system is simulated in proteus simulation environments. The system output as follow. The **(Fig 3)** shows the solar panel-I energy generation as voltage 19v, current 0.70A and power is 13.2w.

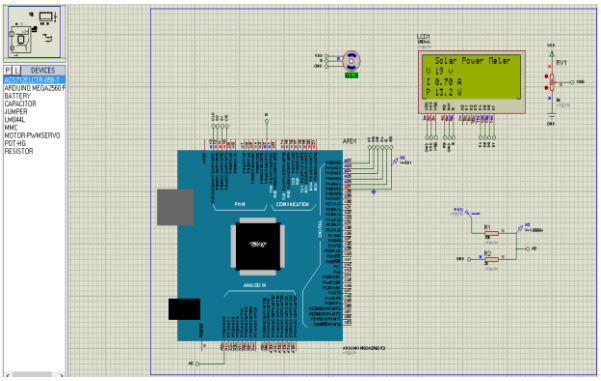

Fig 3. Panel-I Power Generation

The **(Fig 4)** shows the panel-II power generation is as voltage, current and power, 25v, 0.97A and 25.5w respectively.

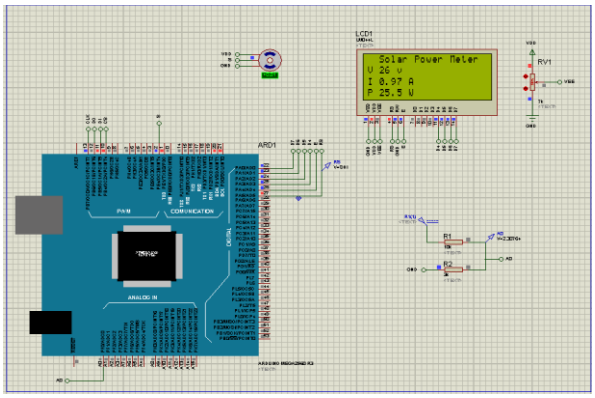

Fig 4. Panel-II Power Generation

The **(Fig 5)** depicts the panel-III solar nergy power generation where voltage, current and power load is 32v,1.21A and 39.0w respectively.

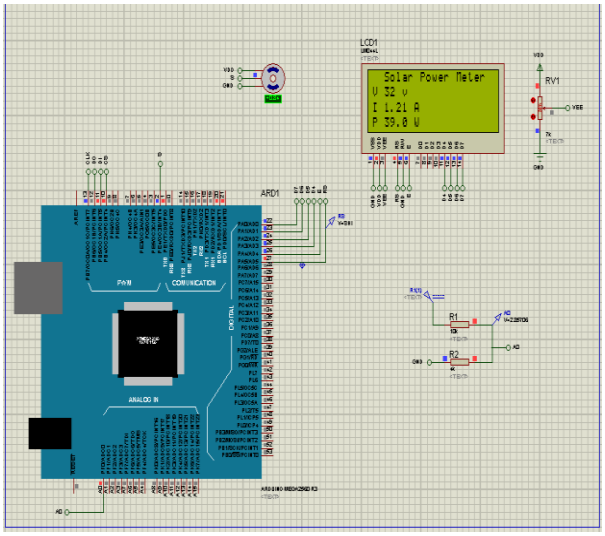

Fig 5. Panel-III Power Generation

The **(Fig 6)** shows the panel-IV solar power generation where voltage, current and power load is 30v, 1.41A and 53.1w respectively during different time in different places.

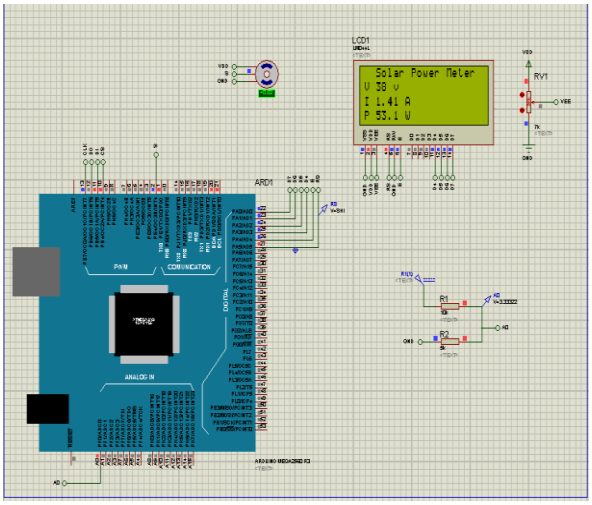

Fig 6. Panel-IV Power Generation

4. HARDWARE MICRO ENERGY SOLAR SYSTEM RESULTS

After simulation, the hardware component has been identified and the system is design for portable device. The mentioned tables shows the hardware energy reading of system during different times in different regions. The hardware system was installed in different regions to check the maximum power availability. The **(Fig 7)** shows the hardware prototype system module.

Fig. 7. Hardware Prototype Micro Solar Energy System

The **(Table-I):** shows the hardware result of the prototype micro solar energy system. Where the system was installed at different place during different time to acquire the solar energy from the proposed system. First time we have installed the micro solar energy system in Hyderabad, Gul Centre on 22/07/2017 from 14:22pm to 20:02pm as shown by table 1.During the day time we have receive different in different hours.

(Table-I): shows the acquire solar power from the micro solar panel installed at Gul-Centre Hyderabad .the below table-I shows the voltage, current and power from the solar panel.

Table 1. Shows Voltage, current, Power Load

Date	Time	Voltage (V)	Current (I)	Power (W)
2017/07/22	14:22:0	7.10	2.13	15.12
2017/07/22	15:05:6	7.65	1.29	9.86
2017/07/22	16:21:8	8.12	2.14	17.41
2017/07/22	17:19:4	8.45	3.25	27.46
2017/07/22	18:20:1	9.00	3.95	35.55
2017/07/22	19:00:3	6.55	3.20	20.96
2017/07/22	20:02:5	4.45	2.02	8.98

Table-2: present the voltage, current and power acquire from the micro solar panel from the kotri area.

Table 2. Shows Voltage, current, Power Load

Date	Time	Voltage (V)	Current (I)	Power (W)
2017/07/23	12:00:0	7.85	1.02	8.07
2017/07/23	13:05:1	8.00	2.10	16.8
2017/07/23	14:21:4	8.85	2.65	23.45
2017/07/23	15:19:3	9.45	3.50	33.07
2017/07/23	16:20:1	9.98	4.59	45.80
2017/07/23	17:00:8	6.50	2.59	16.83
2017/07/23	18:02:1	5.40	2.45	13.23

Table-3 depict the power data acquire from the Dado during the day time. The voltage, current and power results shows different variations of solar energy.

Table 3. Shows Voltage, current, Power Load

Date	Time	Voltage (V)	Current (I)	Power (W)
2017/07/24	13:05:0	7.10	2.20	15.62
2017/07/24	14:45:2	8.65	3.29	28.45
2017/07/24	15:10:9	9.05	3.98	36.01
2017/07/24	16:19:5	9.10	3.25	29.57
2017/07/24	17:20:0	9.55	3.50	33.42
2017/07/24	18:22:2	6.10	2.55	15.55
2017/07/24	19:00:5	4.45	3.02	14.24

The Table-4 present the solar panel power results. It was installed in NawabShah District. The micro solar panel produce more solar energy in summery time particularly in day time. The solar energy generation is depend on the solar panel size.

Table 4. Shows Voltage, current, Power Load

Date	Time	Voltage (V)	Current (I)	Power (W)
2017/07/25	14:22:0	6.10	2.02	12.32
2017/07/25	15:05:6	8.65	2.99	25.86
2017/07/25	16:21:8	9.33	3.85	35.92
2017/07/25	17:19:4	6.45	2.25	14.51
2017/07/25	18:20:1	5.98	2.95	17.64
2017/07/25	19:00:3	4.10	2.10	8.61
2017/07/25	20:02:5	2.45	2.02	4.94

Table-5: depicts the data of Badin District. Where solar panel was installed for few hours to analysis the solar energy potential.

Table 5. Shows Voltage, current, Power Load

Date	Time	Voltage (V)	Current (I)	Power (W)
2017/07/26	14:22:0	8.10	3.22	26.08
2017/07/26	15:05:6	8.95	3.85	34.45
2017/07/26	16:21:8	9.10	4.10	37.31
2017/07/26	17:19:4	7.45	2.95	21.97
2017/07/26	18:20:1	5.10	2.25	11.47
2017/07/26	19:00:3	4.02	1.99	7.99
2017/07/26	20:02:5	3.45	1.50	5.17

5. GRAPHICAL RESULTS

The **(Fig 8).**Shows the graphical representation of table-I as discuss earlier.

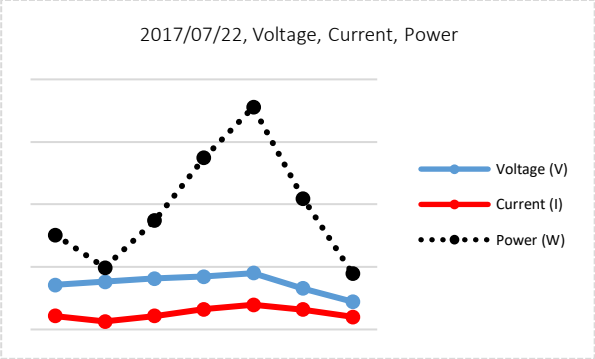

Fig 8. Table-I Graphical Result

The **(Fig 9).** is the representation of table-2 data. It shows the different variation in voltage, current and power.

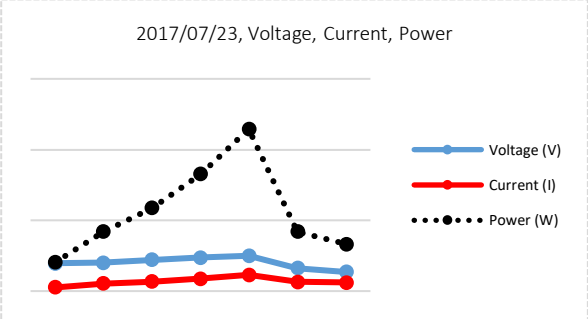

Fig 9. Table-2 Graphical Result

(Fig 10) is graphical presentation of Table-3 where its shows the variations in voltage, current and power generation.

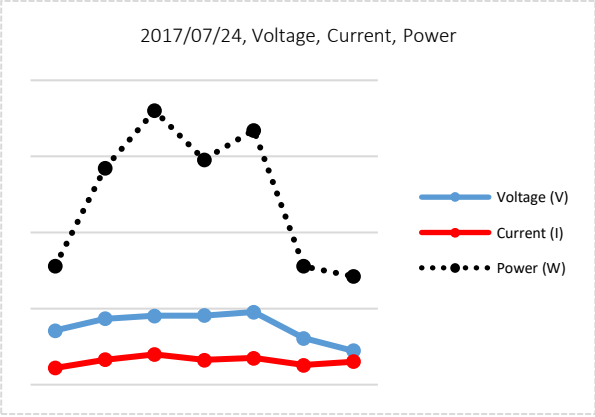

Fig 10. Table-3 Graphical Result

(Fig 11) is graphical presentation of Table-5 where its shows the variations in voltage, current and power generation.

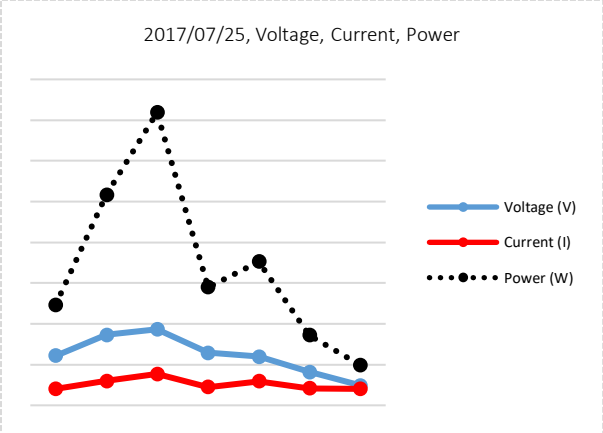

Fig 11. Table-4 Graphical Result

The **(Fig 12)**.is the representation of (Table-4) data .It shows the different variation in voltage, current and power.

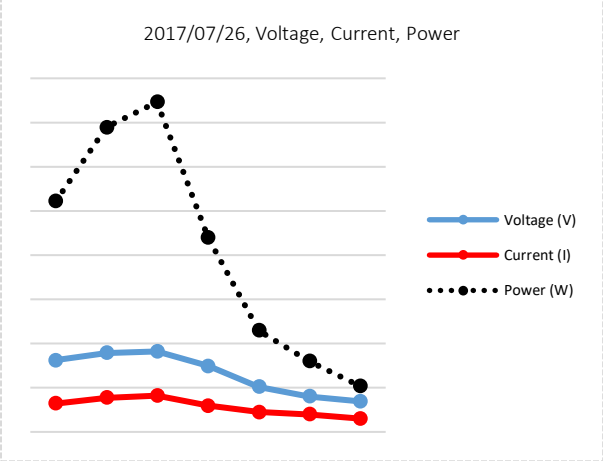

Fig 12. Table-5 Graphical Result

6. CONCLUSION

In this research article we have proposed and design an arduino based micro solar energy system which is used to acquire the solar energy at domestic level to cope the residential energy requirements. The design micro based solar system produce small amount of solar energy for portable electronic devices. It is used to charging the mobile devices, batteries, laptops, battery banks devices and lumps. Moreover, by increasing the solar panel size we can collect more solar energy from the solar. By the implementation of micro solar energy system, the users can produce solar energy independently.

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