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Real Time Monitoring and Control of Solar based Smart Car Parking Canopy

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Abstract: ***India is having a larger potential to harvest solar power. With the advent technology in solar panel manufacturing, the efficiency of the solar panel increases to more than 40%. But with the increase in vehicle production and world population, more and more parking spaces and facilities are required. The objective of this paper is to present an idea on "Real Time Monitoring And Control Of Solar Based Smart Car Parking Canopy". Because of shortage of land area for solar panel installation, researchers are looking for effective usage of available space for energy harvesting. Space to energy (STE) is the upcoming area of research. Mounting a roof top solar panel canopy in the existing car parking lot to harvest the renewable energy and to monitor and control the solar parameters. In addition to this an intelligent system is developed for identifying the availability of vacant space using parking sensors. It is planned to display the parameters of the solar panel and vacant space in the parking lot and the name of the parked car user as an integrated LED console. From the derived solar energy designated converter, which will act as a charging port for the PEV (plug-in electrical vehicle) is fabricated. Installation of solar panel consumes quite good amount of space. The system architecture defines the essential design features such as location of sensors, required number of sensors, solar panels and LEDs for each level.***

Keywords: solar car parking, microcontroller, matrix LED, car battery, ultrasonic sensor, ESP8266 wi-fi module, IOT (Internet of things).

I. INTRODUCTION

Presently, developing new types of energy conversion and storage systems is becoming evident because of increasing human population and thus greater reliance on energy-based devices for survival. Due to the rapid increase in the world population and economic expansion geometrically, this is bringing about rapidly diminishing fossil fuels and the continuously growing environmental concerns as greenhouse gas emissions. Furthermore with the technological advancements in this modern era, more electronic devices are being used to replace manpower thus leading to a further increase in energy consumption. Energy obtained from the sun radiations when in contact with the earth's atmosphere and surface as irradiances is called solar energy. Presently, this is known by humans to be the prime renewable energy in existence till date, the energy produced in day is able of sustaining mankind even when traditional energy sources get finished. This readily available environmentally friendly energy source can easily be obtain via series of methods as photovoltaic, solar thermal energy, artificial photosynthesis, solar heating and also solar architecture. Research works have shown that at the core of the sun, the solar energy is in form of nuclear energy brought about by continuous fusion between hydrogen and helium atoms each second. Thus as a result of this, it radiates out close to 3.8 joules of solar energy each second. With the free and abundant solar irradiances that provides enormous times more energy to the Earth than we consume, photovoltaic processes ensures that not only sustainable but greater efficiency and reliability to access electrical power for charging electric cars anywhere around the world without environmental pollution. With little upkeep, viable approach to self-charging of electric cars wherever need via photovoltaic processes. Solar energy thus provides a unique, simple and elegant method of harnessing the suns energy to provide electric power to electric cars thus taking the world much step closer to a greener community. Currently, PV solar power has become an ideal promising renewable energy supply because of its several edges namely; low value maintenance, non-necessity of moving and no pollution. However, the low potency of a PV panel and high value of PV system installation could also be a discouraging issue as way as its use. Moreover, the nonlinear comportment and heavy dependence of PV modules on the solar irradiation and temperature poses important challenges for researchers in PV solar energy topic .To avoid these limitations, the operation of the PV panel at the MPPT is a requirement which can improve the efficiency of the PV system. Inorder to test the performance of MPPT algorithm, the modeling of PV panel should be done. Therefore, the PV panel is connected to the Arduino mega controller through the voltage and current sensors, that in order to acquire and supervise the photovoltaic voltage, current and power. And to validate the practicality and performance of the developed Solar power mensuration System, a prototype using real components has been developed. Firstly, the employment of renewable energy sources like solar power is accessible to a wider audience due to the falling value of PV panels. Industrial sites and workplace buildings within the

Netherlands harbor a good potential for electrical phenomenon (PV) panels with their giant surface on flat roofs. Examples include warehouses, industrial buildings, universities, factories, etc. This potential is largely unexploited today. Secondly, EVs provide a clean, energy efficient and noise-free means for commuting when compared with gasoline vehicles. The current forecast is that within the Netherlands there will be 200,000 EV work unit in 2020.

This paper tries to present an idea that the readily available solar energy to develop the charging dock. STE concept is also utilized where the available car parking lot is converted as solar car parking canopy. The sensors inside the parking space will show the unoccupied space available for parking. It is hoped that this project may have a great impact in making lives easier and contribute in building smart cities. The remaining section of the paper is organized as below: II. Literature survey, III. Proposed methodology, IV. System implementation, V. Result & discussion, VI. Conclusion, VII. Advantages.

II. LITERATURE SURVEY

The need for vehicle parking place in urban areas is increasing day by day. The need to get a secured parking lot and get it reserved before reaching there is more than before. Many research works have been conducted in this sector. Some research papers were found that discussed about the systems quite similar to the proposed work. In a study [1], a two module system is developed. One module shows the layout animation of the parking lot status and the other module is made to reserve a parking space through sms. In some other studies [2]- [6], parking lot status is made visible using LED lights. Harishraghav et al. used IR sensor modules for the LED to light up [6]. Again, in another study, a smart phone based parking system that detects if there is a parking spot vacant [14]. Another study shows that cars' drivers are given the accurate information about location and availability of car parking spots [21]. In some studies [9] [10], a research has been conducted about wireless sensor technology providing advanced features like remote parking monitoring, automated guidance and parking reservation mechanism. In another study [13], wireless sensor networks can monitor the state of every parking space by deploying a magnetic sensor node on the space.

In a study [5], an android based system is made that regulates the number of cars to be parked on the designated parking area by automating parking and exiting the parking area. In another study, a two module system have been discussed where one is identification of visitors and the other is parking slot status checking [7]. Another study talks about a car alarm getting activated with the owner getting notified by sms using GSM technology [8]. In some studies [15]- [17], a smart system of parking reservation, payment and enforcement have been discussed. Amalendu et al. [15] described that, there was also a system of searching for a vacant spot and the central computer communicates with user terminals and service terminals. In another study [16], identification of urban parking spaces is done by a user-engagement and sonar based prototype. In a study, it is seen that a vehicle parking detection method using normalized cross-correlation of magnetic signals generated by magneto-resistive sensors [19]. And there is also a system that uses automated number plate recognition cameras to efficiently manage, monitor and protect the parking facilities of a university [20].

III. PROPOSED METHODOLOGY

The system consists of ultrasonic sensor, arduino mega controller, charge controller circuit, solar panel, battery. The system architecture is shown in FIG 2.1.

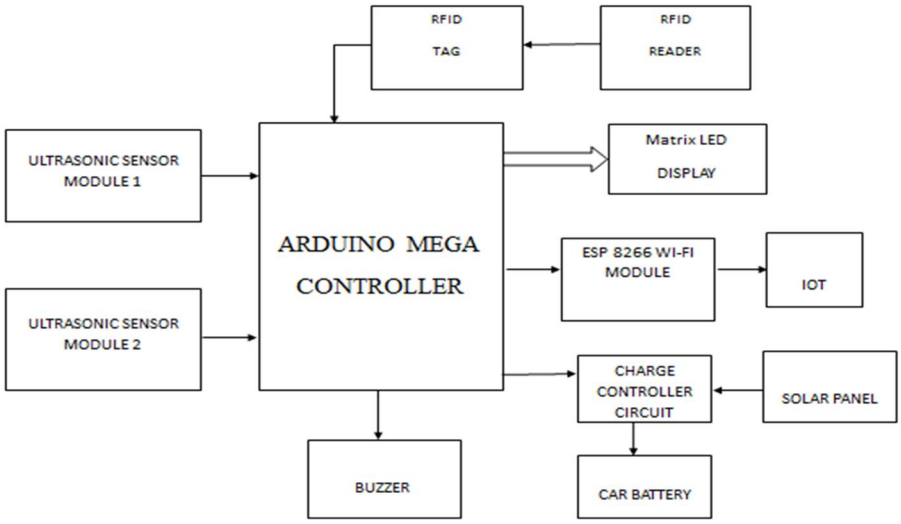

Fig. 1 System Architecture Block Diagram

Mounting a roof top solar panel canopy in the existing car parking lot to harvest the renewable energy and to monitor and control the solar parameters. A smart car parking system for identifying the availability of vacant space using parking sensors. Planned to display the parameters of the solar panel and vacant space in the parking lot as an integrated LED console. Planned to fabricate a designated converter which will act as a charging port for the PEV.

The above system architecture explains that the existing car parking lot has been divided into partitions. An ultrasonic sensor is placed in the partitioned car parking lot at each level. This sensor senses the object and conveys the instruction to LED through ARDUINO mega controller. By using RFID (Radio frequency identifier) method we can detect the owner of the parked car and that will be displayed in the LED console. In this method, an additional advantage also added that the user can check the available space by phone using IOT (Internet of things) and ESP8266 WI-FI module.

And also by using charging controller circuit, we are going to charge the PEV battery and monitoring the solar parameters such as temperature, voltage, current and light intensity. The charging controller circuit consists of MOSFET, connectors, fuse, current sensor, LDR (Light dependent resistor), thermistor and LEDs.

IV. SYSTEM IMPLEMENTATION

At first, a vehicle needs to be registered to gain access in the parking area. When the car enters the parking zone, the RFID reader reads the car tag and display it in the LED along with the name of the car owner. If the parking lot is full, the buzzer will go on. By mounting the solar panel on the roof of the existing car parking lot, the PEV will automatically gets charge. The solar irradiation of the exisiting car parking lot is shown in FIG 4.1.

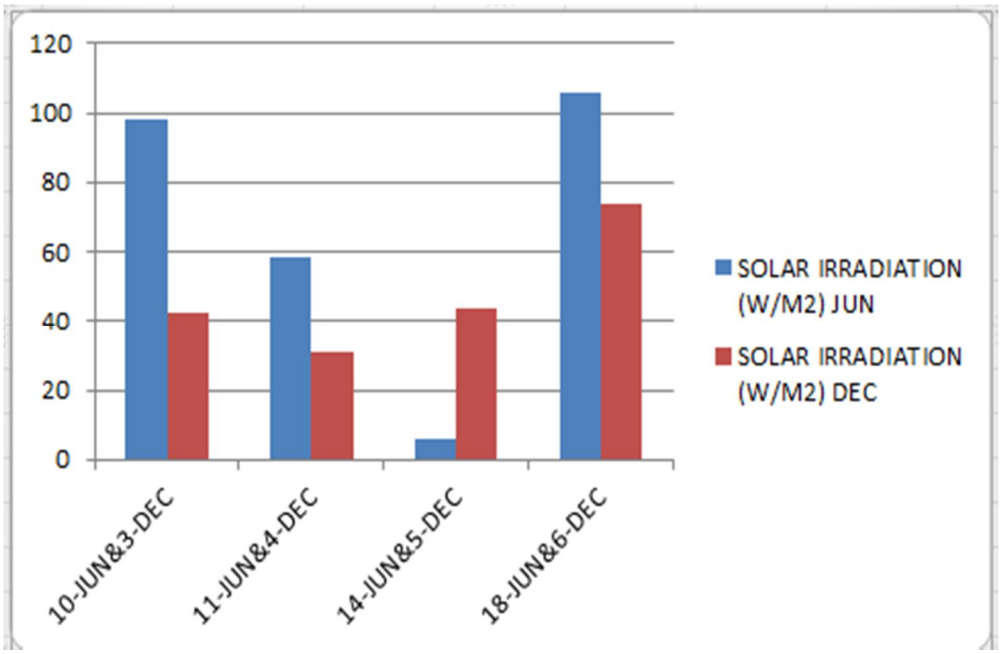

Fig. 2 Solar Irradiation Graph for a Summer and Winter Month of a Existing Car Parking Lot

V_{IN} (V)	V_{BAT} (V)	TEMPERATURE (·C)	INTENSITY (LUX)	CURRENT (Amps)
12.42	11.68	29	129	-6.20
12.42	11.07	30	129	-6.33
12.59	11.65	24	129	-6.28
12.50	11.01	29	130	-6.25
12.54	11.75	28	142	-5.47

Table 1. Solar Parameters in Serial Port of Arduino Software

V. RESULT & DISCUSSION

It is cost efficient. There is no need of any trained person to operate. The circuit is simple. It is a real time implementation. Easily able to park the car by using this method. And we can identify the owner of the car. When compared to other, its time and fuel consuming. Main advantage is that when the car parking lot is full, the buzzer will automatically rang. The solar parameters are continuously run in an integrated console all the time.

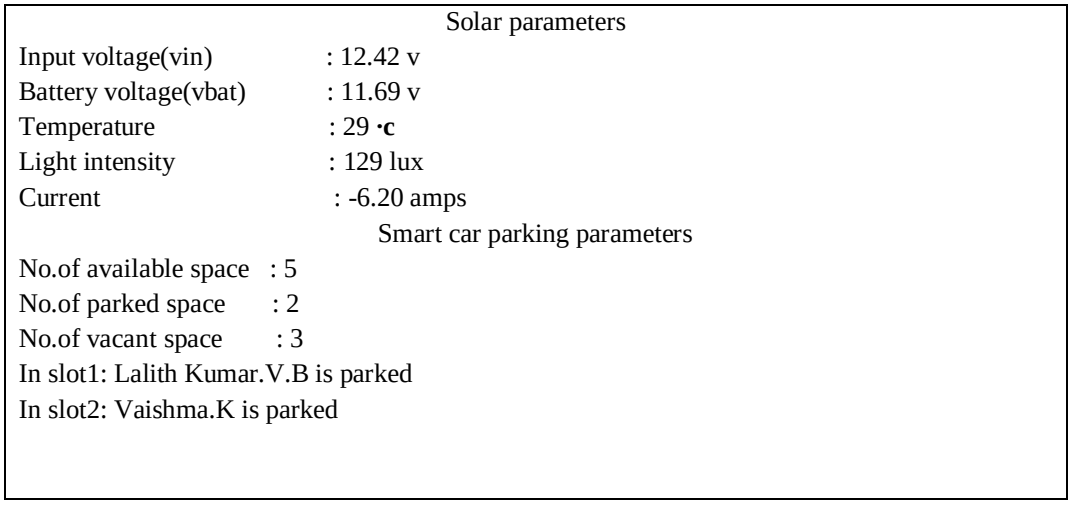

Fig. 3 Output for this paper in the Scrolling LED Display

VI. CONCLUSION

The design and implementation of this converter with switching topology which is a part of DC grid is described in this research work. The performance of the proposed converter based on output power is compared against boost converter. From the simulation and hardware it is observed that the proposed converter overheads the other converters in all aspects.

Since the solar energy generation and charging occurs during the day, thus using photovoltaic to charge electric cars means most of the electric vehicle charging will have to take place during working hours, which will have significant impact on reducing carbon emissions during the day which is the main humane concern. With this piece of work we do hope it serves as a starting point for other research work in this area.

VII. ADVANTAGES

The main advantage of this paper as follows: Charging electrical vehicles are getting more efficient in future because of lack of fuels, By using solar charging station, most of the oil bunks will be replaced by huge battery banks.

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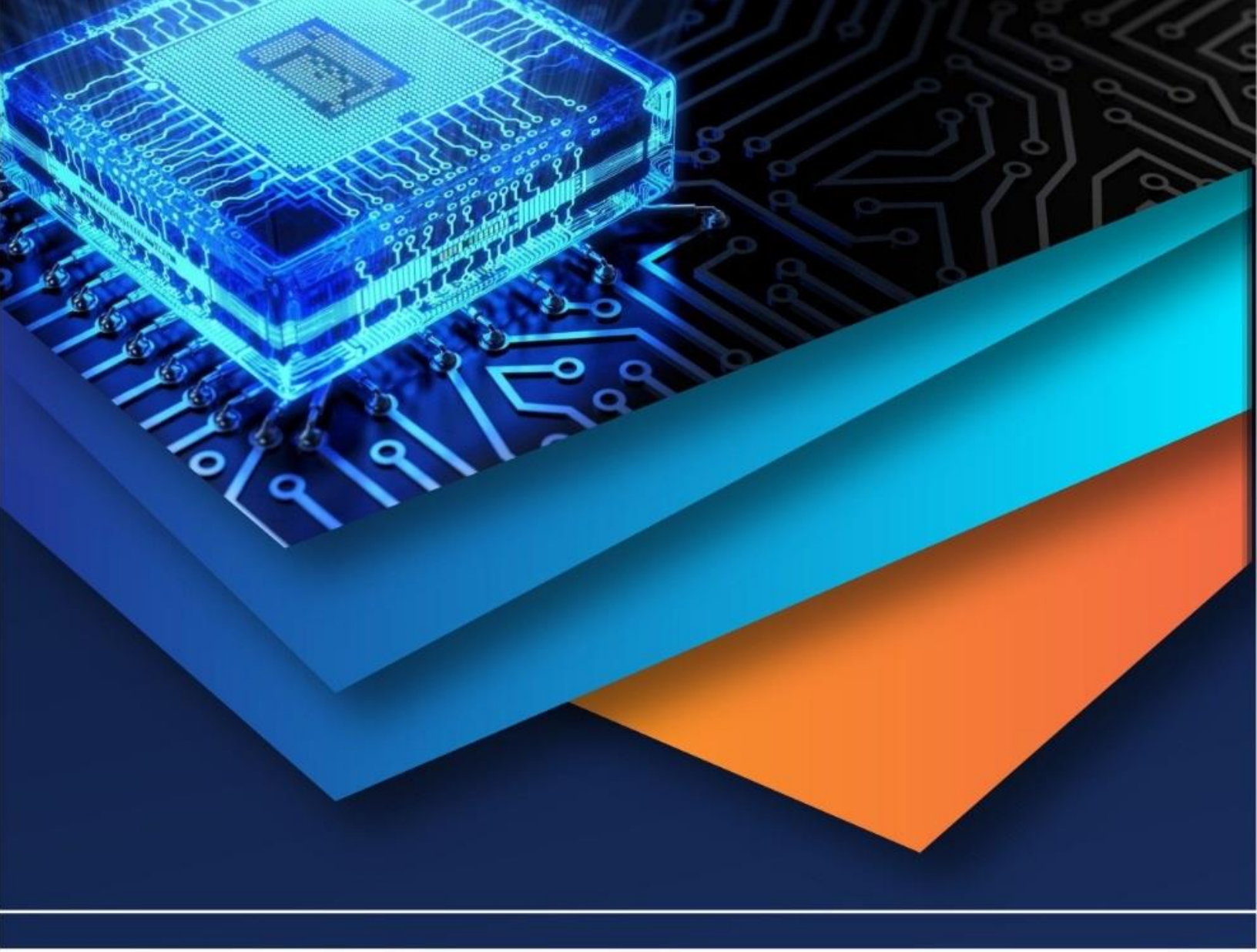

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