Hybrid Renewable Energy System

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Abstract- *Shift of the focus from bulk generation to distributed generation is an established global trend in the power sector. Further, the mode of distributed generations is shifting from dependence on fossil fuels to renewable sources. These sources are intermittent in nature and their generation pattern does not match the load pattern there by creating a need for a battery storage system. In this context, energy management presents itself as inevitable challenge in operating a grid connected distributed renewable sources. The challenge is due to factors such as intermittency of source, time of the day prices, sizing of solar panels, windmills and battery, limitations of charging and discharging rates of the battery. To address these, a design for energy management of grid-connected solar panel and windmill with battery storage is been proposed. The objective is to create an energy budget will lead to balance sheet, which calculates your energy expenditure against generated means to reduce our energy bill. The charge controller of battery uses this algorithm for making decision on charging or discharging of the battery or keeping it in idle mode. The obtained results show effective savings on electricity bill monthly. The optimal selection of number of solar panels, windmills and battery size is been presented.*

The proposed system helps in effectively deriving the potential benefits of grid-connected solar panel and windmill system with battery storage.

I. INTRODUCTION

With the increasing trend in the prices of fossil fuels paired with the decreasing trends in the distributed generation technologies, electricity consumers are gradually shifting towards being electricity prosumers. In addition, some government subsidies are encouraging the customers to have their own renewable energy generation. Rooftop solar now days became more popular because it does not require a separate land space or area. It is flexible to install on the roof of the house or commercial complex. A rooftop solar alone cannot justify the reduction in electricity bill as the solar irradiation is available only during daytime. Solar panels installed along with a battery storage in order to get a better reduction in electricity bill. This battery will help to meet the load during the dearth of solar power. In addition, if the battery is charged and is available to meet the demand during the high grid prices, it will be useful to meet the load as a result there is an increase in the savings on monthly bill.

Achieving the accurate prediction of solar energy however is extremely difficult due to its uncertain and intermittent natures. Energy management strategy for wind energy system is been presented. Here the battery is being utilized in order to reduce the fluctuations on grid that are caused due to wind energy conversion system. By utilizing the battery in grid connected wind energy systems, the output that is been supplied to the load is maintained constant even under the reduced wind power output. Wind energy is being used during the dearth of solar energy and vice-versa. This helps to implement an effective energy management system.

Thus, by utilizing both solar and wind energy sources, an efficient energy budget is achieved which leads to a balance sheet which calculates your energy expenditure against generated means to reduce energy bill.
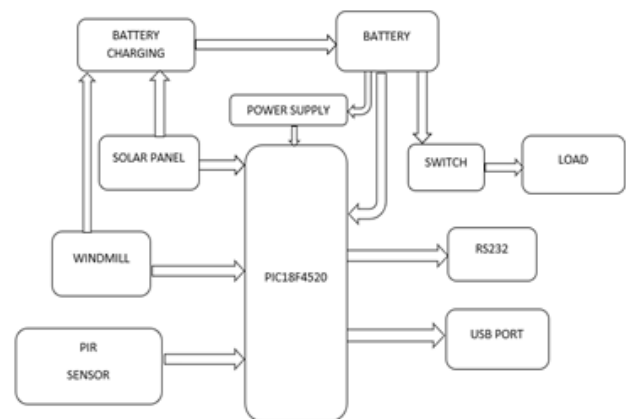
II. BLOCK DIAGRAM AND DESCRIPTION

Fig:1 Block diagram

1 SOLAR PANEL

Solar panel refers to a panel designed to absorb the sunrays as a source of energy for producing electricity.

A PV module is a packaged, connected assembly of typically 4x6 solar cell. Solar PV panels constitute the solar

array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

2 WINDMILL

A wind turbine is a device that converts the wind's kinetic energy into energy. The term appears to have migrated from parallel hydroelectric technology. The technical description for this type of machine id an airfoil-powered generator.

3 PIR SENSOR

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are being used in PIR-based motion detectors.

All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation is not visible to the human eye because it radiates at infrared wavelengths, but electronic devices designed for such a purpose can detect it.

4 LDR SENSOR

A LDR is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor is been applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits.

5 MICROCONTROLLER

A microcontroller is a small computer on a single integrated circuit. A microcontroller contains one or more CPU, s along with memory and programmable input/output peripherals. Program memory is in the form of Ferroelectric Ram, Flash and OTP ROM as well as small amount of RAM.

6 VOLTAGE AND CURRENT DETECTOR

In instrumentation circuitry, DC signals are being used as analog representations of physical measurements such as temperature, pressure, flow weight and motion. Most commonly, DC current signal are used because current signals are exactly equal in magnitude throughout the series circuit loop carrying current from source to load, whereas voltage signals in a parallel circuit may vary from one end to other due to resistive wire losses. Furthermore, current-sensing instruments typically have low impedance, which gives

current sensing instruments grater electrical noise immunity. The standard analog current signal range is 4mA to 20 mA.

7 BATTERY STORAGE

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode.

8 LCD DISPLAY

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. Small LCD screens are common in portable consumer devices such as watches, calculators, and mobile telephones, including smartphones.

We have used an Alphanumeric LCD 16X4(ie.16 character can be displayed and four such lines).
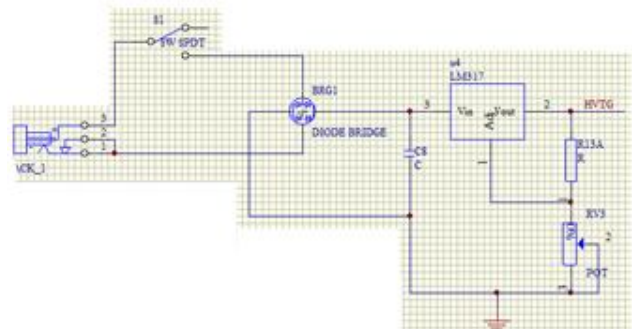
III. HARDWARE SYSTEM DESIGN
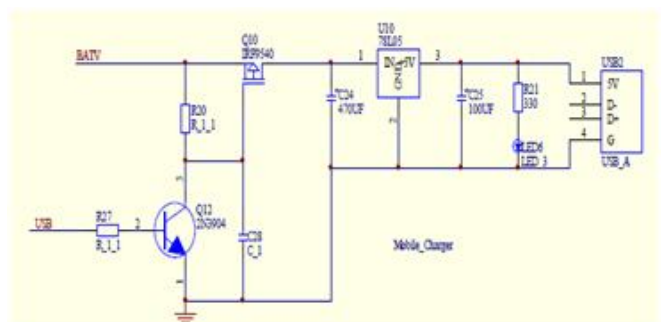

Fig 2. AC to DC conversion Circuit
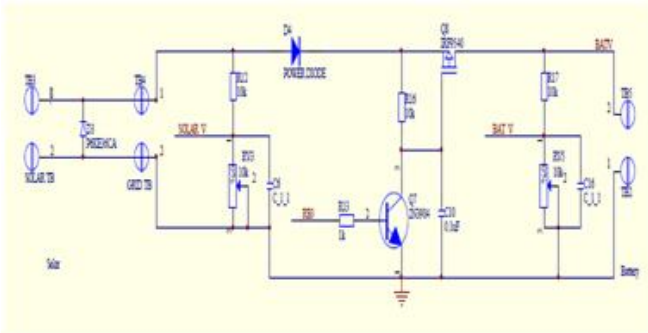

Fig3. USB/Mobile charging circuit

Fig4.Battery charging circuit

IV. SOFTWARE SYSTEM DESIGN

**Designing Graphical User Interface**

C# has all the features of any powerful, modern language. In C#, the most rapid and convenient way to create your user interface is to do so visually, using the Windows Forms Designer and Toolbox. Windows Forms controls are reusable components that encapsulate user interface functionality and are used in client-side Windows based applications.

A control is a component on a form used to display information or accept user input. The Control class provides the base functionality for all controls that are displayed on a Form.
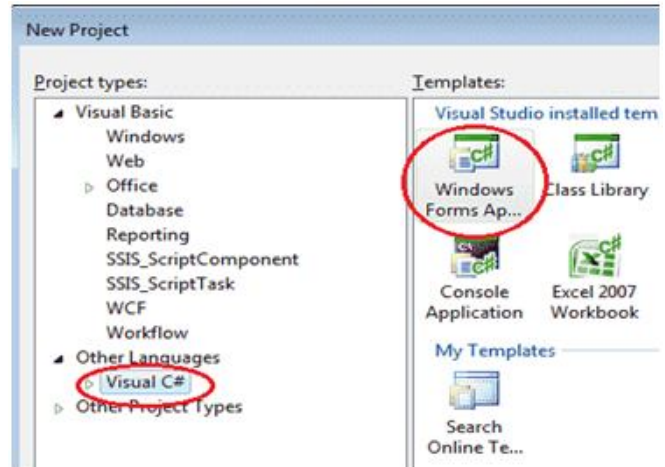
From the following steps you can understand how to place a new control on windows Form.

How to create a new project in C#?

Open your Visual Studio Environment and Click File->New Project
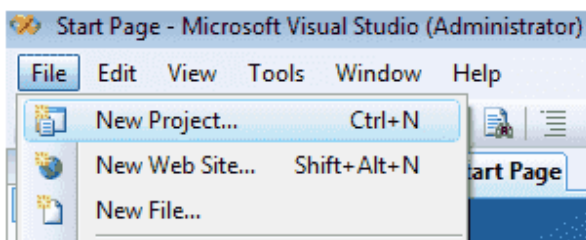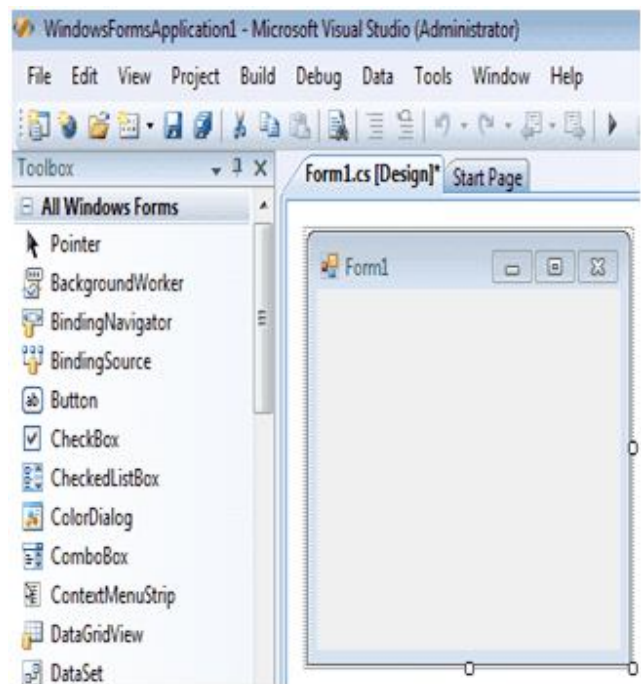

Then you will get a New Project Dialogue Box asking in which language you want to create a new project.


Select Visual C# from the list, then you will get the following screen.

Now you can add controls in your Form Control.

How to add controls to Form?

In the left side of the Visual Studio Environment you can see the Tool Box. There are lots of controls grouping there in the Tool Box according to their functionalities. Just click the + sign before each group then you can see the controls inside the group. You can select basic controls from Common Controls group. You can place the control in your Form by drag and drop the control from your toolbox to Form control.
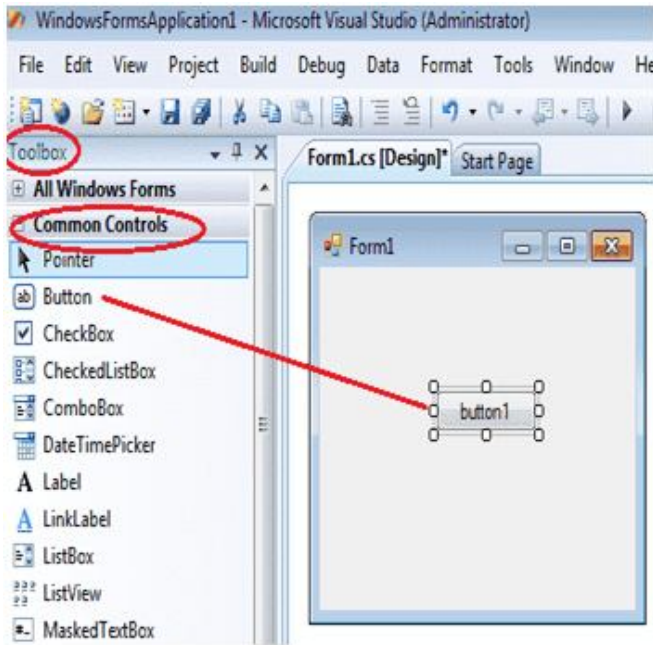
How to drag and drop controls?

In the above picture we drag and drop the Button control from Toolbox - Common control to Form control. Now you can start write codes on each control to create your programs. The Final GUI Front panel would look like the show figure below.
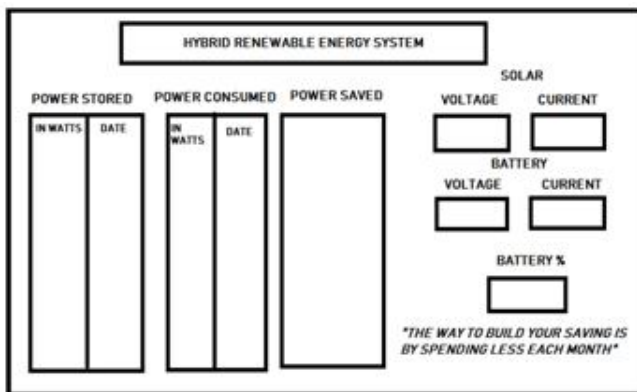

Figure: 6.3.1 Front panel of the GUI

V. CONCLUSION

- The system designed based on the references from various similar designs implemented earlier provides a cost-effective and portable mechanism for achieving efficient energy management.
- It can be further be improved by adding another level i.e. hydro energy for an increased energy budget.

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