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Emergency Power Back Up System Using Bike Or Scooter Battery

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ABSTRACT—A power backup system is crucial for situations when there is a total power failure. There is much equipment like inverter to power electrical equipment, they are not economic and maintenance free. As an easier alternative this paper proposes an emergency power backup system which can power electronic device like mobile phones, modems, during energy crisis. The IC is the core of the designed circuit to implement the algorithm. A charging circuit to recharge the battery after use is also integrated. The result shows that the designed circuit based on the algorithm is effective during the power failures and supports studies based on charging concept.
Keywords— LM2576 Buck circuit, charging lead-acid battery, charging smart phone during power failure.

I. INTRODUCTION

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II. PROPOSED ALGORITHM OF EMERGENCY POWER BACKUP SYSTEM

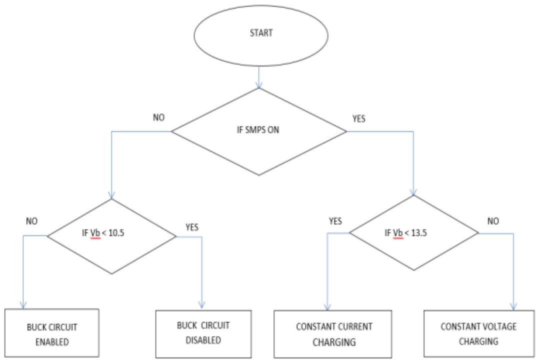

Fig 1 Flow chart of automatic power back up system

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III. IMPLEMENTATION OF ALGORITHM

A. Buck Circuit

Buck converter circuit mainly consists of an inductor, capacitor, diode and a switch. A buck converter is a circuit that steps down the input voltage to a desired voltage at higher efficiency. Fig 2 shows the circuit for a buck converter. The switch used in the circuit controls the output voltage and current and it also decide the overall efficiency of the circuit. Here we have used LM2576 IC as the switch.

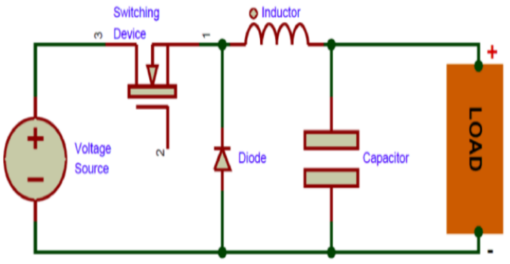

Fig 2 Basic buck circuit

B. Design Considerations

Inductor selection for adjustable version of LM2576:

$$E * T = (Vin - Vout) * \frac{Vout}{Vin} * \frac{1000}{f(in\ KHz)} = (12 - 5) * \frac{5}{12} * \frac{1000}{52} = 56\ V\mu S$$

From fig for a maximum load current of 3A the inductance required is a 68µH

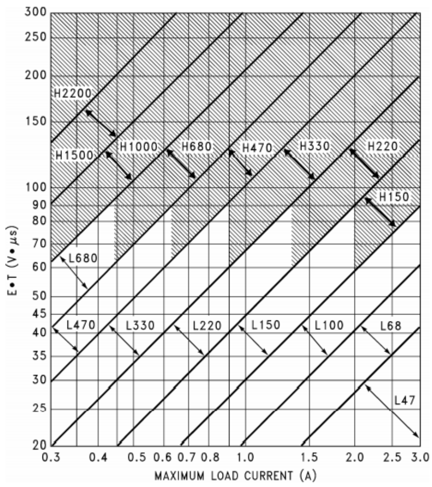

Fig 3 Inductor selection for adjustable IC

Inductor selection for 5V fixed version of LM2676:

Maximum input voltage for LM2576 is 12V
Maximum load current is 3A
From figure the inductance required is 68µH

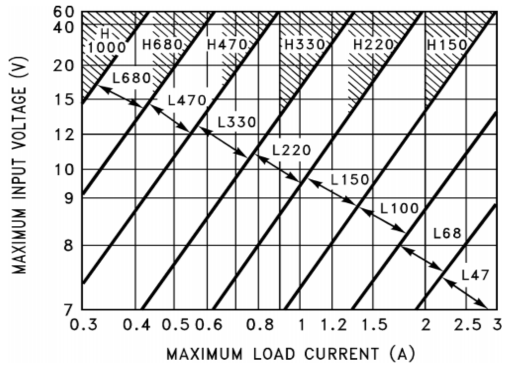

Fig 3 Inductor selection for 5V IC

Output capacitor for buck circuit:

For 5V IC

$$Cout \geq 13300 \times \frac{Vin}{Vout \times L(\mu H)}$$

$$\geq 13300 \times \frac{12}{5 \times 68} = 469.411\mu F$$

For 9V IC

$$Cout \geq 13300 \times \frac{Vin}{Vout \times L(\mu H)}$$

$$\geq 13300 \times \frac{12}{9 \times 68} = 260.784\mu F$$

taking output capacitors be 1000µF and input capacitor 100µF

C. Under voltage cut-off for buck circuit

A fully discharged 12V(nominal) Pb-Acid battery with 0% State of Charge will show a terminal voltage of 10.5V, discharging lead acid chemistry below this threshold is not a recommended practice, so we use a under voltage cut-off circuit to turn off the buck circuit when this threshold is reached. Figure below shows an under-voltage lockout circuit that accomplishes this task. This is nothing much a BJT based NOT gate with Zener diode to determine the cut-off voltage 2N2222A can be used as Q1. This circuit keeps the regulator off until the input voltage reaches a predetermined level.

D. Design

$V_{th} = V_z + V_{BE}$

We are using 2N2222A as Q1, from its datasheet

$V_{BE} = 0.9$ $V_{th} = 10.8V$ $V_{BE} = 0.65V$

$V_z = V_{TH} - V_{BE} = 10.8 - 0.65 = 10.15V$

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take standard values for Zener diodes 5.6V and 4.7V
take BZX5 series of Zener diodes.
R_B = 22K, R_A = 330ohm, let I_C = 500μA

$$Rc = \frac{12 - 0.02}{500 \times 10^{-6}} = 23960 \cong 24K\Omega$$

Take standard value 22 KΩ

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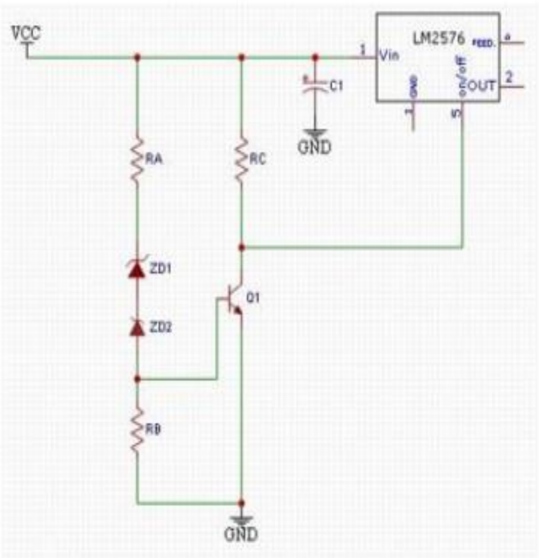

Fig 4 Under-voltage cut-off circuit

E. SOC estimating comparator block

Approximately SOC of a Pb-Acid battery can be obtained from the open circuit voltage (OCV). In this circuit we use 5 LEDs to indicate 5 levels of SOC
(i.e 0% >25%>50%>75%>100%).
Approximately SOC vs OCV used in this design is:

Table I Open circuit voltage and SOC of battery

State of Charge	SOC Open Circuit Voltage
0%	≤10.5
25%	>10.5
50%	>11.5
75%	>12.5
100%	>13.5

In this block we used 4 comparators to compare the predetermined voltages with battery terminal in order to obtain the approximate SOC. LM339N is a quad channel comparator so we can use the same in our circuit. From LM339N datasheet.

. When IN- is higher than common mode and IN+ is within common mode, the output is low, and the output transistor is sinking current.

.When IN+ is higher than common mode and IN- is within common mode, the output is high impedance, and the output transistor is not conducting.

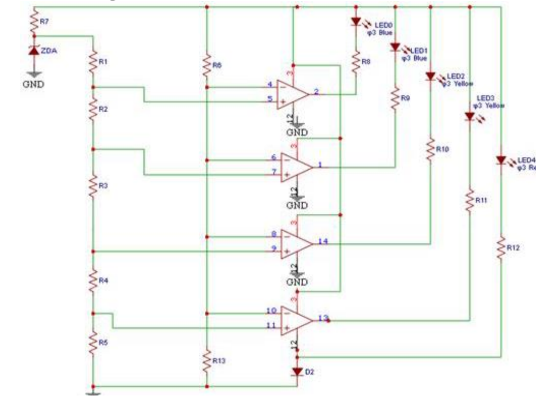

Fig 5 LM339N SOC estimating block

F. Design

V_{ZA}=6.2V
Voltage divider values are fixed experimentally

i.e V_1=4.5V V_2=4.2V V_3=3.8V V_4=3.5V

using voltage divider formula $V_{out} = V_{in} \times \frac{RI}{R+RI}$

R_1=4.7k R_2=1k R_3=1k R_4=1k R_5=10k
ZDA=BZX55C6V2

By substituting these resistance values the required voltages can be obtained.

Resistors for LED's

Let current for LED's be a 3mA let forward voltage drop of LED's be 1.8V

$$\mathbf{R} = \frac{12-1.8}{0.003} = \mathbf{3.4k\Omega}$$

Values of LED resistance is 3.3kΩ

G. Battery charging circuits

Charging stage estimating comparator block

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The charging circuit has 2 stages (Constant Current, C.C & Constant Voltage stage, C.V). The mode of charging is a function of the present SOC of the lead-acid battery, thus the mode of charging is also a function of battery voltage. The switching of the charger from C.C to C.V can be done by monitoring the terminal voltage of the battery this can be achieved by using a comparator IC in the circuit. LM358 is a good solution for this. LM358 can be used as a dual channel comparator. Only one comparator is required for this block but another comparator can be used for adding additional functionalities to the circuit like indication circuit when battery is fully charged or anything.

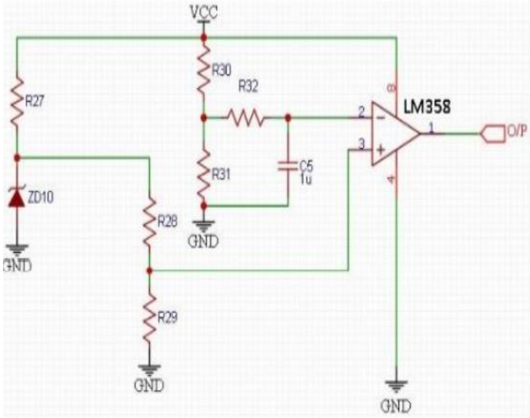

Fig 6 LM358 based charging stage estimation block

H. Design

Battery terminal voltage divider design

Let 13.5V be the threshold up to which constant current charging needs to be done, after that constant voltage charging needs to be done. let the resistor divider voltage be 4.3.

$$\frac{R30}{R31} = \frac{13.5}{4.3} - 1 = 2.14$$

$$R30 = 2.14 \times R31$$

Let R_{31}= 22K

R_{30} = 22K *2.14 = 47.08K

Choose standard value

R_{30}= 47K R_{31}=22K

Reference Voltage divider design

let current through Zener diode be 8mA

$$R27 = \frac{Vin - Vz}{0.008} = \frac{14.2 - 6.2}{0.008} = 1K\Omega$$

$$\frac{R28}{R29} = \frac{6.3}{4.3} - 1$$

$$\frac{R28}{R29} = 0.441$$

Let R_{29}= 100K

$$R28 = 0.441 * 100K$$

R28 = 44.1KΩ

For R28 take 2x 22KΩ

When battery reaches 13.8V an oscillation of 130Hz is observed so an RC delay circuit with time constant greater than $\frac{1}{130}$ is included.

$$T = \frac{1}{130} = 7.7ms$$

So let the time constant be €=50ms let R_{32} = 47KΩ

$$C_s = \frac{0.05}{47000} = 1\mu F$$

I. Relay driver

Relay is used to switch CC and CV and its also used to switch the circuit as buck or charging.

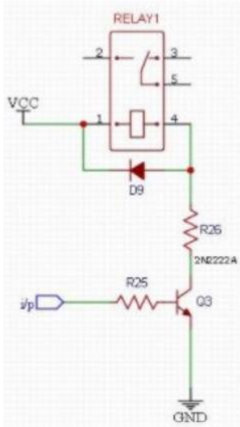

Fig 7 BJT based relay switch

J. Design

Let I_B= 5mA V_{in}= 12V from comparator

$$R25 = \frac{Vin - Vbe}{Ib} = \frac{12 - 0.65}{0.005} = 2.2K\Omega$$

$$R26 = \frac{Vin - Vce(sat) - Vrelay}{Ic} = \frac{14.2 - 0.2 - 12}{0.050} = 40\Omega$$

Choose standard value R_{26}= 33Ω

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K. LM317 based constant current source
LM317 based Constant Current Source LM317 maintains 1.25V across output and adjust terminal thus it can be used as a constant current source.

L. Design

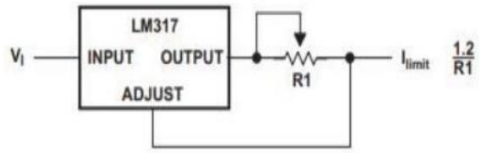

Fig 8 LM317 based constant source

$R1 = \frac{1.25}{1} = 1.25\Omega$ Choose $R1 = 1.2\Omega$

M. LM317 based constant voltage source
LM317 can be used as a programmable voltage regulator

N. Design

$$Vout = 1.25 \times \left(1 + \frac{R2}{R1}\right)$$

$$Iout = \frac{1.25}{Rs}$$

$I_{out} = 1A$

$R_s = 1.2\Omega$ $V_{out} = 14.2$

$$14.2 = 1.25 \times \left(1 + \frac{R2}{R1}\right)$$

Let R1 be a 10K POT, as error in the calculation may exceed the value of V_{out} which may result in the gassing of electrolyte. We can adjust the POT and make 14.2V

IV. CIRCUIT DRAWING AND PCB LAYOUT

Easyeda is used to draw the circuit diagrams. All the components are available in the easyeda library.

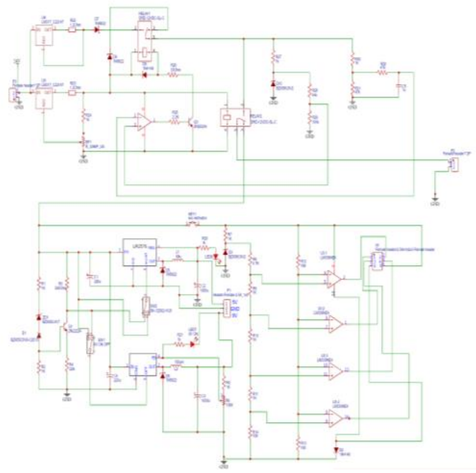

Fig 9 Circuit diagram

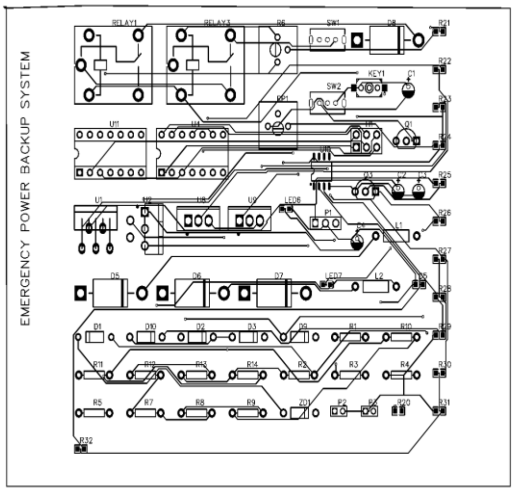

Fig 10 Top Layer

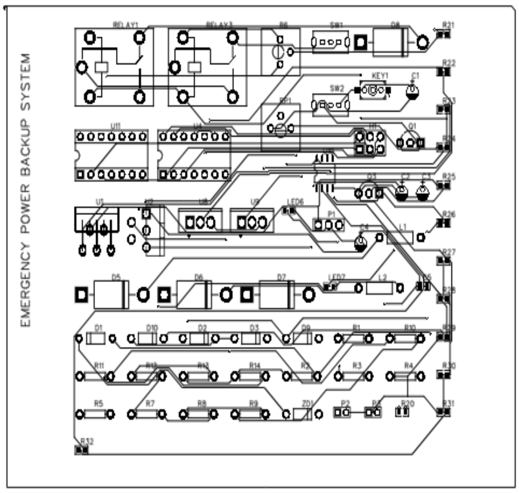

Fig 11 Bottom layer

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REFERENCE

[1] G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955. (references)

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[3] I. S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.