UAV POWER FAILURE DETECTOR SYSTEM

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ABSTRACT

Unexpected failures of UAV electrical power systems were happened in many power supply circuitry due to various randomreasons. This paper focuses on the most reliable design, simulation and implementation of a circuit to detect imminent failure of electric power provided by an electric power supply due to the low or loss of input voltage in order to take an action. The tasks of the circuitwere to detect voltage drop or rise and produce an alarm.The mechanism of the detection is based on differentiating the voltage level using dualcomparators. The method enables real-time monitoring of stability boundaries and the corresponding margin to the observed operating point, which was used to provide an early warning for emerging stability problems.

Keywords- Power Failure, Early Warning Of Power Failure Systems, Voltage Differentiator.

I. INTRODUCTION

Many electrical systems had witnessed a series of blackouts. These events demonstrated the need for reliable supply of electricity. Many of the blackouts were initiated by a single severe disturbance (loss of generator) or even a multiple related events (i.e.); afault and a subsequent relay disoperation). A real-time monitoring of the power system stability is widely used for obtaining an early warning of emerging stability problems.A real-time monitoring provides appropriate countermeasures to prevent the emerging blackouts and the electrical system faults. Faults on electric power systems are an unavoidable problem. Usually electrical power systems control centers contain a large number of alarms received as a result of different types of faults. To protect these systems, the faults must be detected and isolated accurately. The development of an apparatus for detecting imminent failure of electric output power provided by an electric power supply due to the reduction or loss of input power becomes a necessity.

II. RELATED WORK

Computer systems and specific instruments usually require early warning of imminent power failure, to provide sufficient time for an organized system shutdown. During the shutdown, sufficient energy must be stored in the power supply to maintain the output voltages above the minimum specified values.

Rapid progress in the modeling of electric power disturbance events is evident in the last two years of research funding program [1]. This progress lends hope that real-time predictive modeling of these events may be feasible in the near future. Such real time modeling may enable faster acting automated and manual controls during the early stages of a disturbance in order to dampen oscillations and improve transient stability. Daume

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[2] shows several instances where a regional early warning system for electric power disturbances could have alerted operators to necessary actions prior to islanding, and thus preserved service for the majority of customers. However, Paul W. Oman and Jeff Roberts, (2002) [3], indicated the following barriers to electric power disturbance early warning systems;

- Absence of wide-area protection-level communications infrastructure.
- Fragility of the Internet and other telecommunications infrastructures.
- Lack of network quality of service guarantees and industrial strength service agreements.
- The variety of control station and substation communications protocols and their lack of interoperability.

Recently, emerging technologies based on computer networking and electric power system protection might be used to overcome obstacles and foster development of such an early warning system [4].
Frequency Response is the characteristic displayed by load and generation within control areas, and therefore an interconnection, in response to a significant change in load resource balance [5]. Because the loss of a large generator is much more likely than a sudden loss of load, frequency response is typically discussed in the context of a loss of a large generator. The energy used (by loads) must be equal to the energy provided (by generators) to maintain a steady frequency. Frequency is essentially the same throughout an Interconnection and is easy to measure. Frequency information can be useful in many areas of power system analysis, operation and control.

III. DETECTOR ALARM CIRCUIT

A simple circuit consisting of a dual voltage comparator integrated with Op amp, voltage regulator, resistors, DC power supply, and a led was designed, simulated, and tested to monitor a supply voltage drop or voltage rise and produce an alarm signals to alert operators for in-time action as shown in figure 1. A differential (dual) comparator LM 358 with open collector outputs were used to compare a supply (unregulated) voltage to a regulated (reference) voltage. Pull-up resistors of 1 KΩ were used. The circuit was simulated using Multisim12 Software

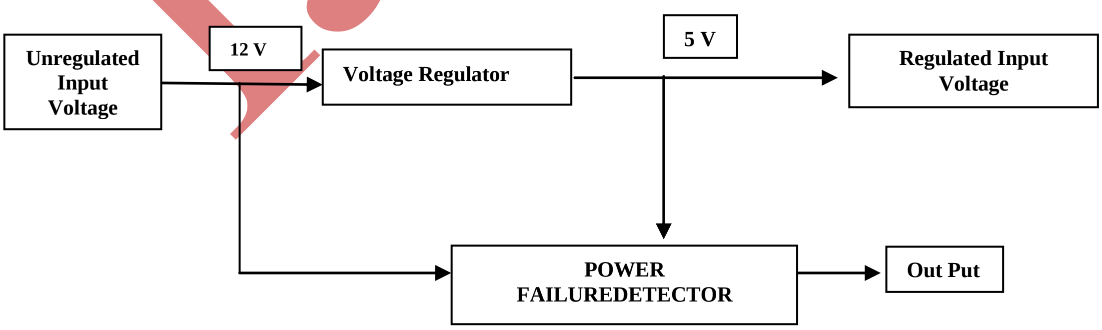

Figure (1): Block Diagram for power failure Detector

The circuit diagram shows a simple configuration consisting of a dual comparator(IC LM358).The two op-amps are arranged in a differential mode and as comparators. Both the comparators consist of their own discrete

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voltage sensing components.The presets provided with the op-amps decide at what point the outputs of the both the op-amp remain on the same level that is at zero potential.Also the above condition is met when the voltage level over approximately at the same levels. However the comparators instantly detect this and one of the relevant op-amp outputs goes high. And when the voltage level decreases the comparator give signal to the connected alarm mechanism. An IC LM 358 dual voltage comparator with open-collector outputs was usedto design such a circuit. Typical pull-up resistor values are1k. Power supply for the LM 358 should be VCC =5V. Select the configurations and component values to meet the above demands. Standard components were used.

Since the voltage divider circuit of Figure 2 does nothing more than produce reference voltage that sets the value of V_{in} that will result in V_{out} changingstates, this voltage divider circuit can be replaced by the label V_{ref}, which can becalled the reference voltage [6].

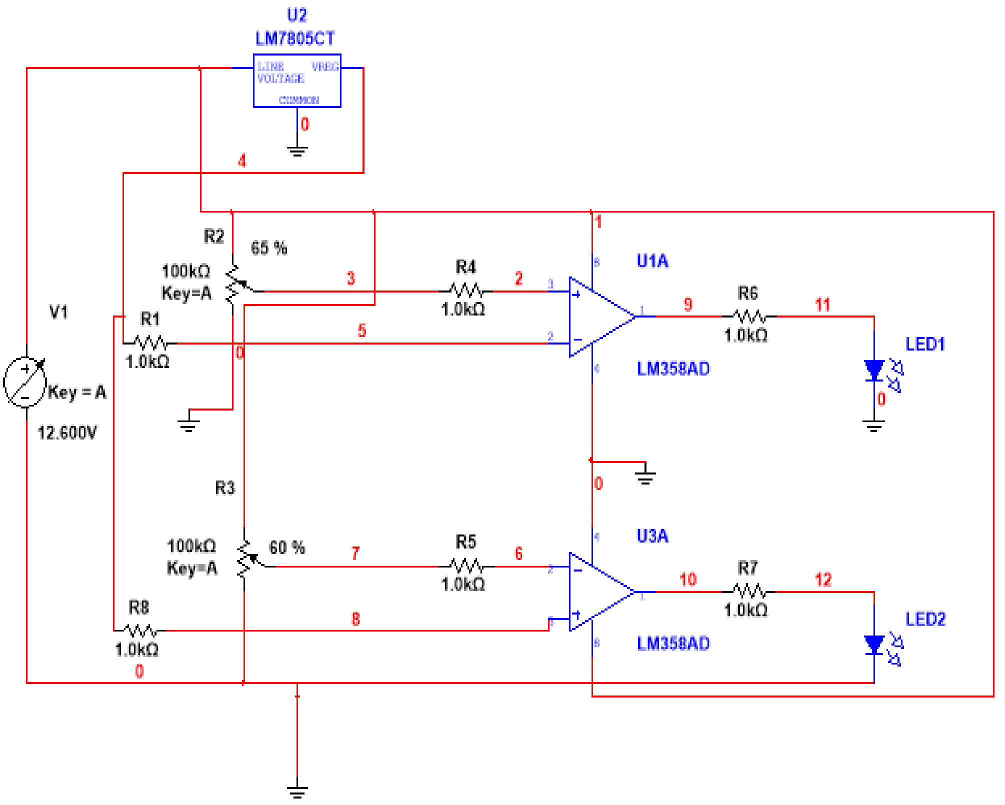


Figure (2): A comparator circuit alarm

$$V_{out} = +Vcc \text{ for } V_{in} < V_{ref}$$

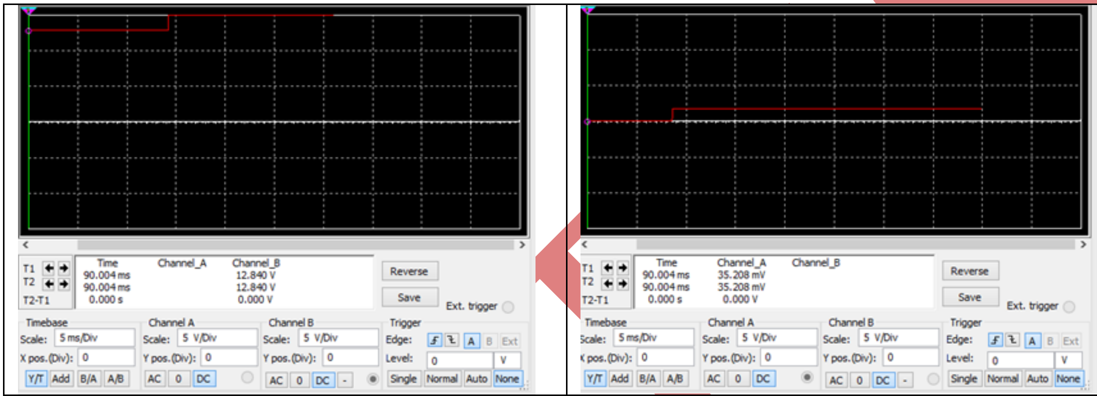
$$V_{out} = 0 \text{ for } V_{in} > V_{ref}$$

IV. APPLICATION AND RESULTS

Table 1 shows the supply voltage and its variation limit that the detector can detects,

Table (1) Output voltage variation

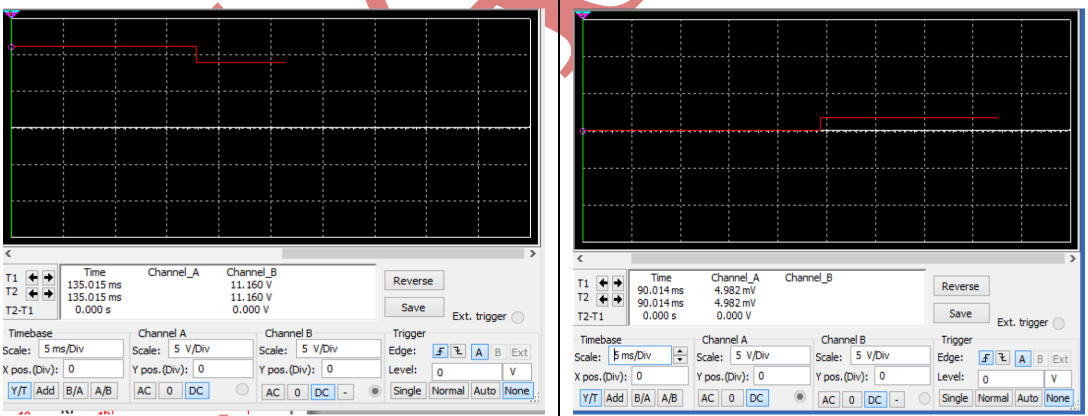
Voltage supply	Max. voltage	Min. voltage	Variation
13.5 v	14.85 v	12.02 v	+10% ,-11%
12.5 v	13.75v	11.125 v	+10% ,-11%
10.5 v	11.55 v	9.35 v	+10% ,-11%
9.5 v	10.5 v	8.5 v	+10% ,-11%



(a):Voltage source when increase

(b):Voltage increases , LED is ON

Figure (5 a-b):Wave form voltage Source and LED when the voltage is increase



(a): Voltage source when voltage drop

(b): Voltage drops, LED is ON.

Figure (6 a-b): Wave form voltage Source and LED when the voltage drop

V. CONCLUSIONS

A dual comparator (IC LM 358) was successfully simulated as a detector of power voltage fluctuation. Simulation results reflect the effectiveness of the algorithm of detection of the comparator. A circuit was designed and implemented to validate the results of the simulation. Variable input voltage was used to determine the threshold voltage value beyond it; the circuit produces alarms and warning.

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