Analysis of Signals by a Polygraph Device Using MATLAB

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Abstract

The ability to differentiate between the human emotions and between truth and lying has become increasingly difficult as well as very important. In light of the large scale corporate, political scams being carried out, the ability to detect lies would be greatly useful in this context. In this paper, the basic responses have been studied that any human being would undergo involuntarily when trying to hide, lie or in any way modify the information. The nervousness that would come out as a function is related directly to level of falsification and inversely proportional to the truth that the person is trying to tell. The proposed system is based on three basic circuitries which would enable us to accurately measure the various components of nervousness.

The polygraph setup measures the breath rate, the heart rate and the galvanic skin resistance through real time measurements. These are then analysed with the help of a MATLAB based program which intends to pick up variations and unusual spikes in these signals. A competent psychologist trained in the nuisance of polygraph would be able to employ the system to greatly aid his work.

Keywords: Nervousness, real time, MATLAB software.

1.   INTRODUCTION

A polygraph (popularly referred to as a lie detector) measures and records several physiological indices such as blood pressure, pulse, respiration, and skin conductivity while the subject is asked and answers a series of questions. The belief underpinning the use of the polygraph is that deceptive answers will produce physiological responses that can be differentiated from those associated with non-

deceptive answers. Polygraph examiners, or polygraphers, typically begin polygraph test sessions with a pre-test interview to gain some preliminary information which will later be used for "control questions", or CQ. Then the tester will explain how the polygraph is supposed to work, emphasizing that it can detect lies and that it is important to answer truthfully. Then a "stim test" is often conducted: the subject is asked to deliberately lie and then the tester reports that he was able to detect this lie. Guilty subjects are likely to become more anxious when they are reminded of the test's validity.

Criticisms have been given regarding the validity of the administration of the Comparative Questions test (CQT). The CQT may be vulnerable to being conducted in an interrogation-like fashion. This kind of interrogation style would elicit a nervous response from innocent and guilty suspects alike. There are several other ways of administrating the questions.

An alternative is the Guilty Knowledge Test (GKT), or the Concealed Information Test (CIT), which is being used in Japan. The administration of this test is given to prevent potential errors that may arise from the questioning style. The test is usually conducted by a tester with no knowledge of the crime or circumstances in question. The administrator tests the participant on their knowledge of the crime that would not be known to an innocent person. When these questionnaires are administered then with the help of the polygraph, the related signals are picked up and then used by the psychologist to determine the level of truth or lying in the person.

2.   OBJECTIVE

The objective of this paper is to obtain the related autonomic signals from a subject and analyse them to detect nervousness of the subject. Further, the detected signal is given to a GUI of the signals to simplify analysis and finally set up a conducive environment for inducing lie related stress.

3.   PROPOSED SYSTEM

In this section, the focus is on the use of sensors and different components combined together to carry out the work. Inputs from the sensors are processed through the MATLAB software and the output is given to the screen in the form of a GUI. A power supply of 5volts is also incorporated with the system

Design and development of the system

Development of the complete polygraph system includes lots of study and implementation work. The implementation work of the complete data logger is divided into points as discussed below.

Power Supply: As per the power requirement of the hardware of polygraph system, supply of +5V w.r.t

GND is developed as shown in the Figure 1. The complete circuitry is operated with TTL logic level of 0-5V.. It comprise of 0V to 12V transformer to step down the 220V AC supply to 12V AC. Further a bridge rectifier converts the 12V into 12V√2 DC. It is further filtered through a 1000uF capacitor and then regulated using 7805 to get +5V. To isolate the output voltage of +5V from noise, further filtering 220uF capacitor is done.
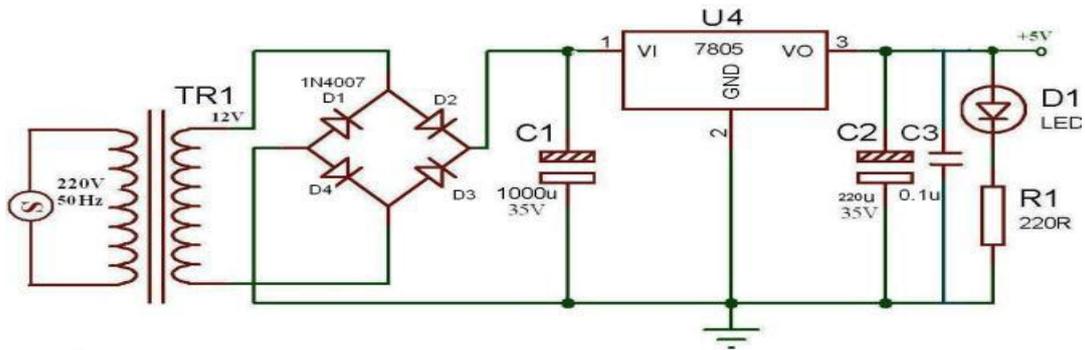
Figure 1: Circuit Diagram of Power Supply

CIRCUIT DIAGRAM AND OPERATION

Figure 2

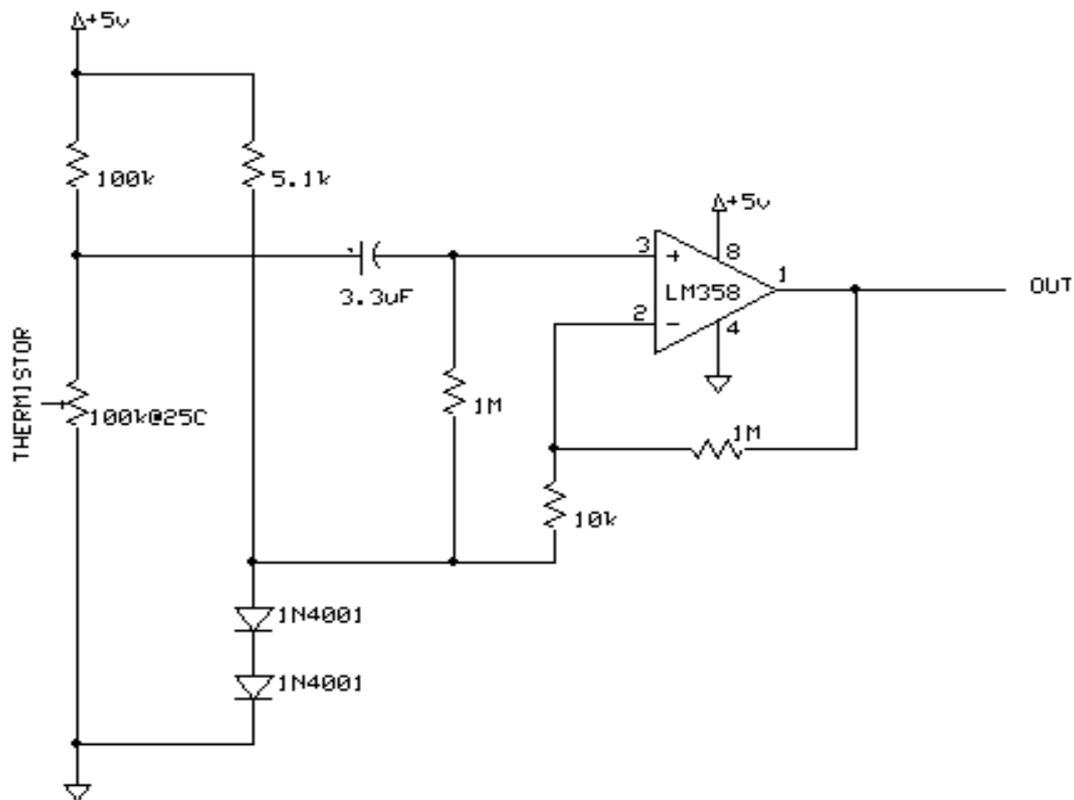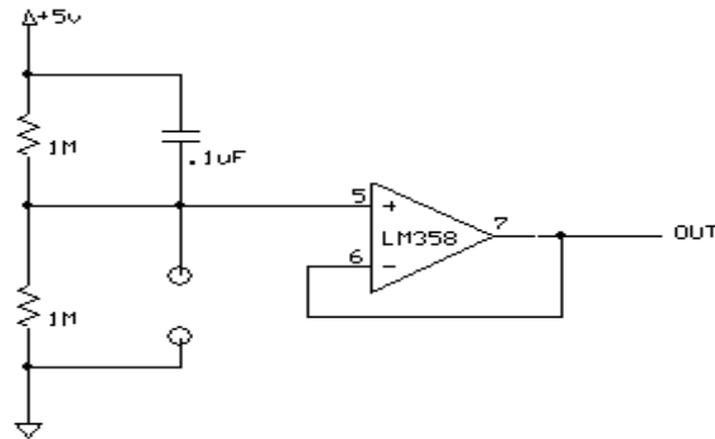**Figure 3.**

The operation of this system is based on the proper detection of the required parameters ie. the breath rate, the heart rate and galvanic skin response. These are taken via circuits developed by biomedical specialists. These were incorporated into this circuit to give an increased accuracy for the measurements. As for the heart rate, a stethoscope is directly taking the heart beats measurement and variations into the MATLAB software.
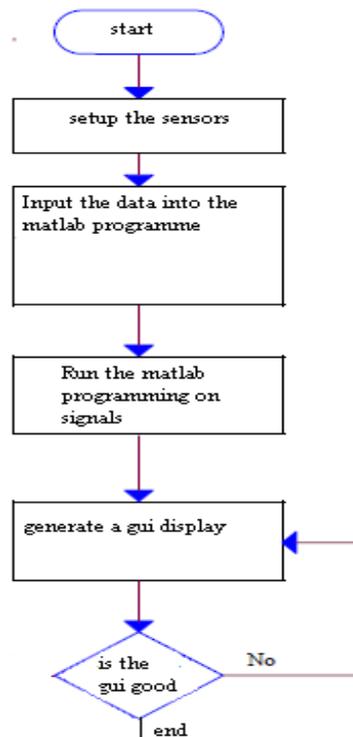

Figure 4: Flow Chart

After the signals have been properly taken in, the work load is transferred using MATLAB software. Direct sine transform of the signal is performed at a very fast rate. The graph of the signal is then plotted. With respect to the maximum signal levels, the normal level can easily be seen. These signals can then be analysed by a trained psychologist

4. CONCLUSION

In this paper, the working of the Polygraph model was studied and the required signals which would enable the observer to measure the nervousness was considered. And other physical aspects of the subject when given an appropriate questionnaire were successfully done using this Polygraph model. Also signals were displayed on a GUI with the help of MATLAB software. As to the aspect of detection of lies, a naïve observer would be able to detect lies with seventy percent accuracy.

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