TORQUE WRENCH VERIFICATION SYSTEM

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ABSTRACT—

This project is made to verify whether the nuts and bolts are tightened at output stage. The model has been programmed by embedded system which works as a wireless communication system using some input-output peripherals. The major components used are Nrf24L01, LM1117 (voltage Regulator) & Atmega8.

The transmission of signals between the transmitter and receiver is carried out wirelessly through SPI (Serial Peripheral Interface). In this model we are using 4 transmitters and 1 receiver where the nrf are connected at the transmitters and receivers for the communication. A seven segment display is connected at the receiver end to show the count of number of nuts tightened.

So basically this project gives us the verification whether the nuts are tightened properly with the help of torque-wrench.

INTRODUCTION

Torque-wrench is a mechanical instrument used in the industries to fix the nuts and bolts.Torque wrench testers (TWTs) are basically used in many of the applications, specially in automobile industries. Torque Wrenches are employed in a variety of professionals including mechanics and mechanists. Electronic torque wrenches are available in wide number of sizes to fit many applications in which some of the models are programmable.[1]

Measurement of Torque in production and manufacturing is generally performed with hand torque measuring tools, more generally known as " Assembly tools for screws and nuts".[4]

These torque wrenches are designed for various precise applications and measurement of torque value without the need for providing necessary support for calibration or setting equipment. They have bidirectional tightening.

There are four basic types of torque wrenches which has different operating principles.They are- beam or deflection torque wrench, dial indicator torque wrench, clicker, and digital torque wrench.The click torque wrench works by a mechanism of spring tension inside the wrench.The tighter the spring, the more twisting force is required to make it click.[7]

Torque wrenchs may seem like luxury thing that is not necessary but it is very useful for some specific and important reason.

APPLICATIONS

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- Safety Engineering: Hydraulic **torque wrenches** are double acting tools that are used for tightening and loosen bolts. They operate through the force of a hydraulic flow which provides necessary pressure to force the wrench in rotating motion.[2]

- Automotive Industry: There are primary types of **torque wrenches** used in automotive industry.They are- hand torque wrench and pneumatic wrenches.[3]

- Aviation Industry: Hydraulic torque wrenches are used for tightening large torques in aircraft maintenance for aviation and heavy machinery assembly.[5]

- Medical technology: A dental torque wrench or restorative torque wrench are used to precisely icon the medical portal.[6]

- Viscometry: Torque wrenches are used to measure the viscosity of the liquid.

COMPONENTS USED

a) *nRF24l01*:

The nRF24l01 is a single chip 2.4 GHz trans-receiver module, that is each module can both send as well as receive data with an embedded based protocol suitable for very low power wireless applications. It is designed for operation in the ISM frequency band at 2.4 GHz.[8]

The nRF24L01 can be operated and configured through a Serial Peripheral Interface (SPI).The register map contains all configuration registers in the nRF24L01 which is accessible in all modes of operations.

nRF24L01 is normally used in industries for projects based on data transmission. Some of the basic things where it is used are computer, toys, remote control games and many other electronic devices.

This transceiver module consists of a frequency generator, mode controller, power amplifier, crystal oscillator, modulator and demodulator.[10]

b) *LM1117*

The LM1117 is a low power positive voltage regulator designed to convert the power of 20V to different range of voltages required by specific application. This device is used in battery powered applications and portable computers.LM1117 is available as adjustable or fixed values of voltages in the range of 1.5V, 1.8V, 2.5V, 2.5V, 3V, 3.3V and 5V output voltages.[11]

Applications: High efficiency linear regulators, Battery chargers, Portable computers etc.

The LM1117 is made by the Texas Instruments.

c) *ATmega8*

ATmega8 is an 8 bit AVR (A hardware Device use to maintain a voltage to electronic devices) Microcontroller based on RISC (Reduced Instruction set computing) architecture which is mainly used in the Embedded System for industrial Automation Projects. A Microcontroller is a computer based single integrated circuit which performs one task at a time for one specific application. It contains input output Peripherals, a Processor and Memory.[12]

The Programme memory has 8k Flash used to store a number of instructions, while RAM and EEPROM are the two other memories that contains 1k and 512 Bytes respectively.[13]

Some features of this module are it acts as a power up timer, in-circuit serial programming etc.

The 10 bit ADC module is added in ATmega8 device which plays an important role for sensor interfacing. Communication Protocols are added to the device such as SPI, I2C, &

USART that are used for establishing a communication between external devices.[14]In model the ATmega8 is connected to the NRF for signal transmission, 7 segment display for count of nuts, LED & Switch.
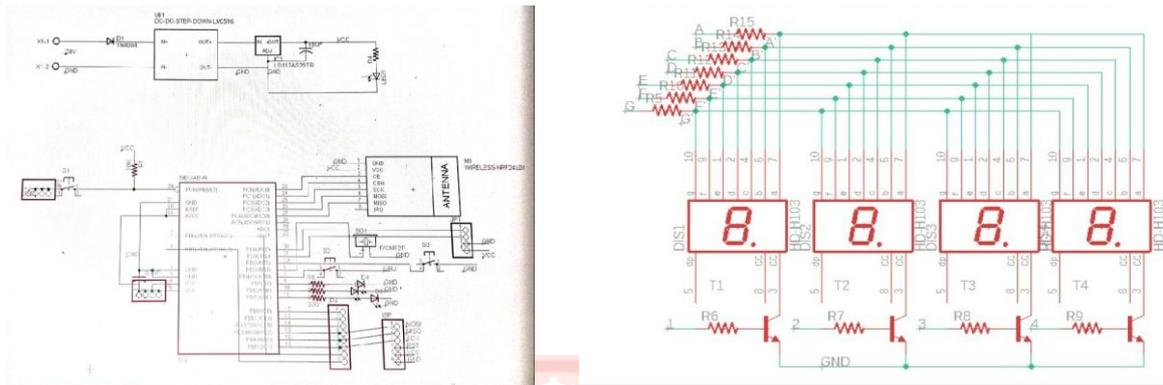
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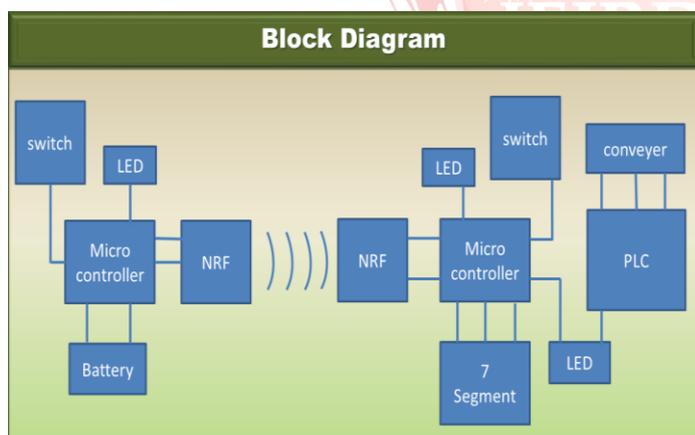
The above block diagram shows the circuit working of the torque wrench verification system.The circuit consist of the transmitter part and the receiver part:

- Transmitter: The components connected at the transmitter part are a switch, a battery, a led, the

  nRF where all these components are connected to the microcontroller ATmega8.The switch is to be pressed by the user to give signal to the microcontroller, as the microcontroller receives the signal the led glows.The signal from the microcontroller is converted into the data and sent to the nRF which is connected at the output port of the microcontroller.

The nRF at the transmitter then transfers the data to the nRF at the receiver through the SPI(Serial Peripheral Interface).

- Receiver: The components placed at the receiver side are the nRF, the microcontroller ATmega8, 4 7-segment display, led and the buzzer.The data received by the nRF is transferred to the microcontroller where the microcontroller gives the signal to the 7-segment display which displays the count whether the nuts are tightened.At last, when all the nuts are tightened led will glow indicating that all the nuts are tightened and the 7-segment display will display all zeroes.

CONCLUSION

- The manual work for labours is reduced and more accuracy is achieved with the help of this model. Industries can use this model as a replacement for labours to check the number of nuts and bolts tightened.

- This model can also be compacted in its size to suplly the final product to the industries.

REFERENCES

1) https://en.m.wikipedia.org/wiki/Torque_wre.

2) P. D. Hohmann "Advantages of Traceability by using torque transfer standard TTS" XIII IMEKO World Congress pp. 253-256 1994.

3) K. Ogushi A. Nishino K. Maeda K. Ueda "Range Expansion of the Reference Torque Wrench Calibration Service to 5 kNm at NMIJ" Measurement

4) https://youtu.be/3v3hLvuO_KU.

5) "JIS B4652" "Hand torque tools - Requirements and test methods" 2008.

6) K.Ogushi T. Ota K. Ueda "Calibration of a torque wrench checker using the reference torque wrench" in 25th Sensing Forum Japan Saga pp. 183-186 2008.

7) "The Guideline for Calibration Laboratories of Torque Testing Machines and/or Torque Wrench Tester" Japan Measuring Instruments Federation 2007.

8) https://www.caranddriver.com

9) https://youtu.be/5XzKvEnk1FY

10) https://www.sparkfun.com

11) https://www.seedstudio.com

12) https://www.instructables.com/id/LM1117-Linear-Voltage-Regulator/nch

13) https://www.theengineeringprojects.com/2018/09/introduction-to-atmega8.html

14) https://www.alldatasheet.com