

# DATA ACQUISITION USING TENSILE STRENGTH TESTING MACHINE

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**Abstract** – One of the most important characteristics required for design, production quality control and life prediction of industrial plant is strength of a material. Textile materials has been designed, manufactured and its performance tested by tensile tester.

**Key Words:** tensile, strength, strain, stress.

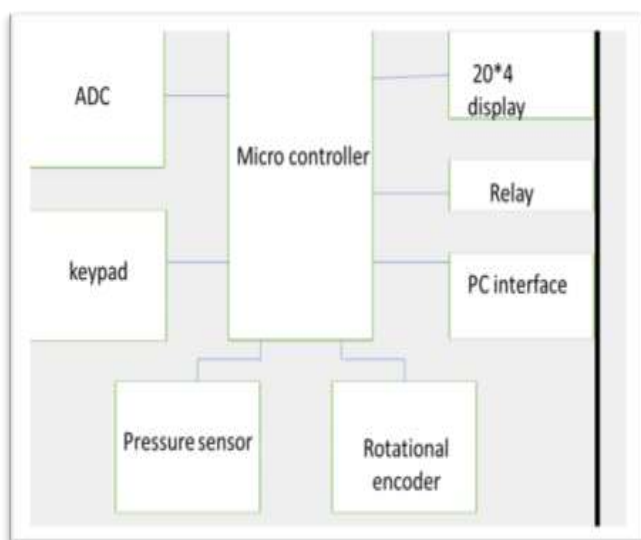
## 1. INTRODUCTION

A universal testing machine is used to test the tensile strength and compressive strength of material. The “universal” part of the name reflects that it can be perform many standard tensile and compression tests on materials. Scope of our work is interfacing load cell and rotational encoder and sending information to PC.

The EU funded project TENSTAND addressed a) the issues of computer controlled tensile testing, b) validation of tensile software, c) the issues of speed of testing Tension is measured by load cells of different measuring materials.

Software routines are developed for different tests which are includes load-elongation (or stress-strain) curve, tension change under constant elongation, creep test and force and elongation lost under cyclic loading.

## 2. BLOCK DIAGRAM



### 1. MICRO-CONTROLLER

The microcontroller board based on the AT mega 2560. It has 54 digital input and output pins. The microcontroller simply connect it to the computer with a USB cable it with a battery or AC-to-DC adapter to get started. The operating voltage of microcontroller is 5v It has 16 Analog pins. This microcontroller has different types of specification like 1) 86 general purpose I/O lines 2) High-performance 3) six flexible timer/counters with compare modes 4) 8KB SRAM 5) 16-channel 10-bit A/D converter 6) PWM 7) 32 general purpose working registers 8) real time counter 9) ISP flash memory 10) oriented 2-wire serial interface

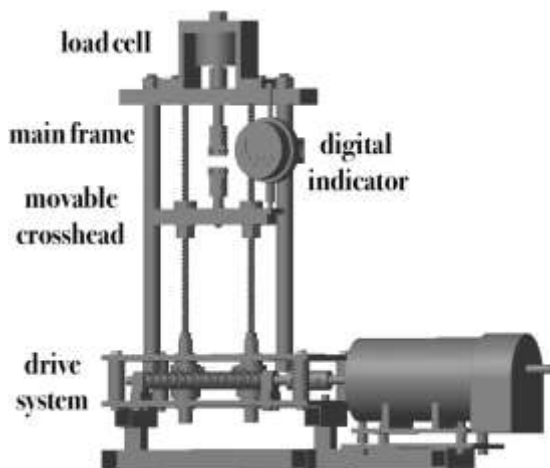
The device accomplish at throughput of 16 MIPS at 16 MHz and operates between 4.5-5.5 volts.

A single clock cycle executing by powerful instructions, the device derive a throughput approaching 1 MIPS per MHz, processing speed and balancing power consumption.

## 2. LOAD CELL

Strain gauge load cell work on the principle that the strain gauge (a planer resistor) deforms when the materials on the load cells deforms appropriately. In a Wheatstone bridge configuration a load cell usually consists of four strain gauge. The output voltage of load cell is 2mv/v.

A load cell is converts force into a measurable electrical output. Although there are many varieties of load cells, strain gauge based load cells are the most commonly used. In laboratories where precision mechanical balances are still used, strain gage load cells dominate the weighing industry. Where intrinsic safety and hygiene are desired, and hydraulic load cells are considered in remote locations, as they do not require a power supply there is Pneumatic load cells are sometimes used. Strain gage load cells offer accuracies from within 0.03% to 0.25% full scale and are suitable for almost all industrial applications.



### 3. ROTARY ENCODER

Rotary encoder is specifically used to determine the elongation of specimen we used to measure the tensile strength. It is used to convert the angular position or motion of the shaft to analog or digital output signals.

A rotary encoder, also called a shaft encoder, is an electro-mechanical device that converts the angular position or motion of a shaft or axle to analog or digital output signals.

Absolute and incremental are two main types of rotary encoder. The output of an absolute encoder indicates the current shaft position, making an angle transducer. The incremental encoder provides output of an information about the motion of the shaft, which typically is processed elsewhere into information such as position.

### 4. ADC

24-bit ADC which is used here is HX711 type. 24-bit ADC is used here to get the more counts. ADC is interfaced with the microcontroller 2560 by using the SPI (serial peripheral interface) protocol.

HX711 is an ADC chip with preamplifier included. It is designed for weight scales applications. To measure weight provide voltage outputs in millivolts the load cells usually used. We can use HX711 microcontroller because outputs are difficult to handle directly by controllers.

By using ADC converter, regulated power source, output amplifier (noise reduced) we measure weight using load cell. There are all these three features need three separate different type of circuits and components adding to cost and complexity all the above features simply removing complex circuitry. So we can use HX711 IC.

### 5. PC INTERFACE

RS-232 is a standard for serial communication. The standard defines the electrical characteristics & timing of signals, the

meaning of signals, & the physical size & pinout of connectors.

For a serial communication interface RS232 is a standard allows to send and receive data via at least three wires. By using the RS232 interface is easy to setup a connection between a microcontroller and a PC or between two microcontrollers.

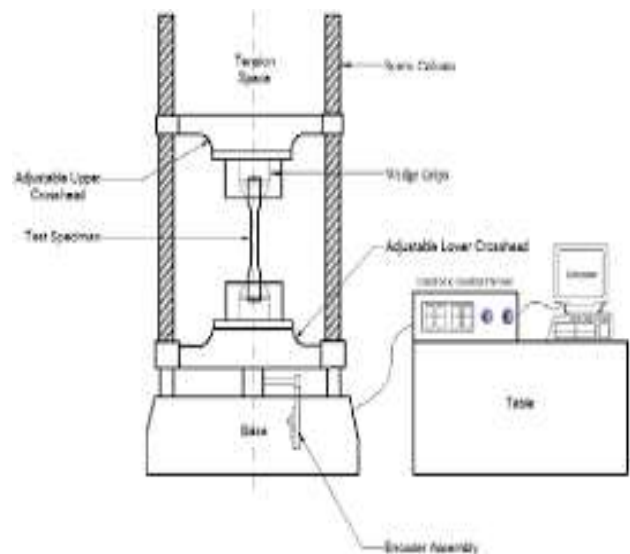
### 6. KEYPAD

Here 8\*3 matrix keypad is interfaced with the microcontroller. This keypad is used here to give an input to the system that follows an encoding scheme that allows it to have much less output pins than there are keys.

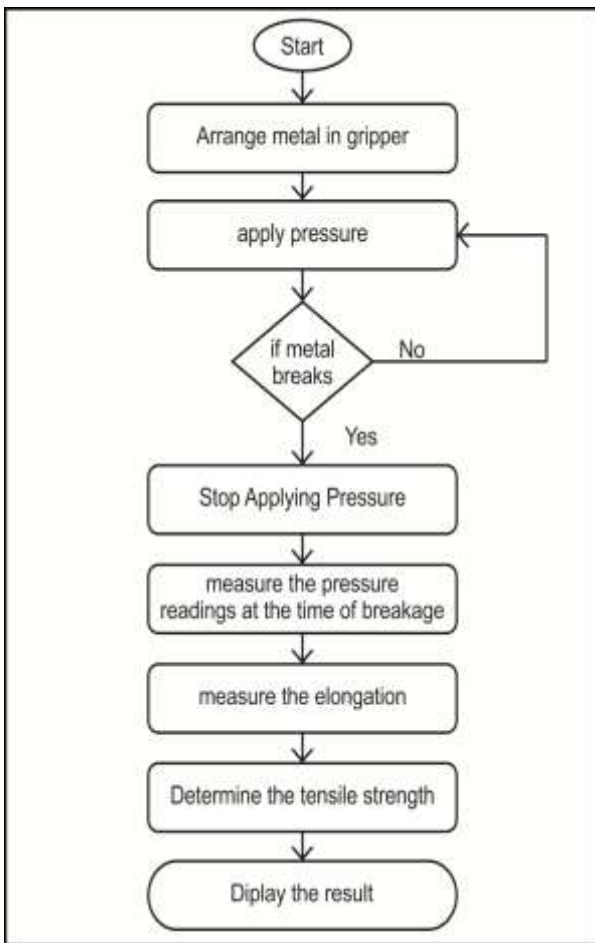
Typically in the keypad there is an one port pin is required to read a digital input into the controller. When there are more number of digital inputs that have to be read, it is not feasible to allocate one pin for each of them. So, the number of pins of keypad that are used to interface a given number of inputs decreases with increase in the order of the matrix. Initially all switches are assumed to be released. So there is no connection between an rows and columns. When there is any one of the key are pressed, the corresponding row and column are connect. The colour red and black is for logic high and low respectively. Here are the steps involved in determining the key that was pressed.

### 7. LCD DISPLAY

To display the output 20\*4 LCD display is used here. It can display there are 4 such lines and 20 characters per line. In this 20\*4 LCD display each character is displayed in 5x7 pixel matrix.

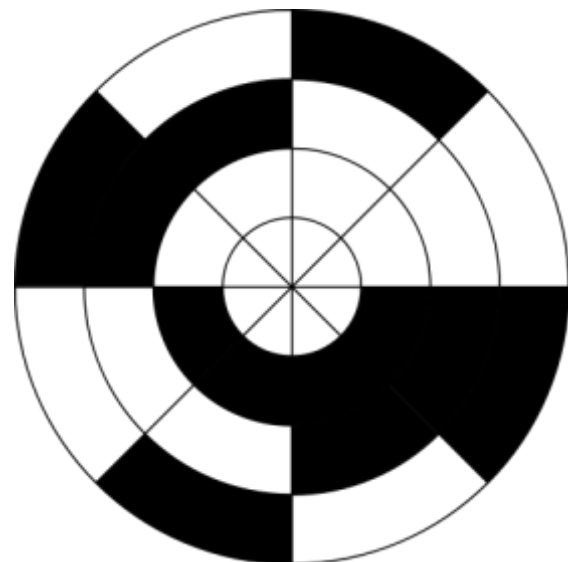


### 3. FLOW DIAGRAM:



## 5. RESULT AND DISCUSSION

### ENCODER



In the Rotary encoder for angle-measuring devices it marked in 3-bit binary system. There is an different types of rings are available in that the inner ring corresponds to Contact 1 in the table. Black sectors are "on". On the right-hand side Zero degrees is available, with angle increasing counter clockwise and also anticlockwise.

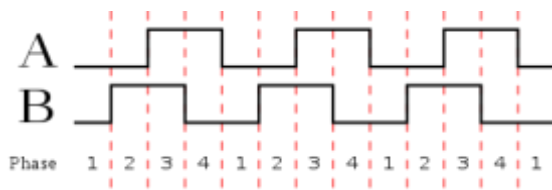
### WORKING PRINCIPLE

In the machine between the grips and an extensometer the specimen is placed if required can automatically record the change in gauge length during the test. The machine itself can record the displacement between its cross heads on which the specimen is held If an extensometer is not fitted. So, this method is records the change in length of the specimen as well as record all other extending / elastic components of the testing machine.

It started begins to apply an increasing load on specimen. The load and extension or compression of the specimen record the tests the control system and its associated software.

### 4. ELECTRONIC DESIGN

Electronic system of the device and signals. By a personal computer (PC) Motor is controlled and data is read from load cell. Digital signals of encoder are read and recorded by PC. Encoder signals are read to determine the position of servo motor and hence displacement of movable clamp. Through a data acquisition card the Communication between servo motor, load cell signal and PC is possible.



In quadrature Two square waves. By the sign of the A-B phase angle the direction of rotation is indicated which, in this case, is negative because A Trails B.

DISPLAY:



On LCD display initially it gives values of load and CHT (cross head travel).

## 6. CONCLUSIONS

The construction, design and calibration measurement of a universal testing machine for tensile tests on thin and soft materials were discussed.

The performance of the proposed testing machine following the work done to calibrate the loadcell, used to obtain the compliance of the machine, and the data acquisition are discussed.

## REFERENCES

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