Weight Automation with Data Acquisition System

[1] Asso. Pro. H. P. Tiple, [2] Akshata A. Gosavi, [3] Taminee S. Gaonkar,
[4] Reshma T. Bavdane, [5] Vaidehi V. Karandikar,
[1,2,3,4,5]Electronics & Telecommunication Engineering, Mumbai University,
S.S.P.M's College of Engineering Kankavli, Maharashtra, India.
[1]hemant.tiple@rediffmail.com, [2] akshugosavi2@gmail.com, [3] taminigaonkar281@gmail.com,
[4] reshmabavdane72@gmail.com, [5] karandikar6@gmail.com.

Abstract - In modern globalization, many technologists are trying to update a new development based on automation which works very rigidly, high effectively and within short time period. The progressive invention in auto weighing system is becoming an important task especially because of rising demand of products and declining labor availability in industry. In recent years, in industry the weight of the jobs are checking and then faulty jobs are rejected manually. But nowadays we can check the weight of the object using the automation (using Load cells) technique and faulty jobs rejected using PLC and accurate jobs pass to further process on the conveyor belt. In industry the production speed should be high because demand of the product is more. But when we check the weight of the object manually then it will take more time for checking the weight and overall speed of the production will decrease. The PLC used are costly. Hence the purpose of this paper is to implement weight automation system using Arduino 2560 to make automation system cost efficient.

Keywords- **Arduino ATmega 2560, Load cell, RTC, Relay, SD card.**

I. INTRODUCTION

The weighing scale technique started since 1974 is used to only measure the quantity of product. In this technique weight object is kept on one side and weight is kept on other side. This system is very bulky it does not store the data and the result is approximated which consist inaccuracy. In modern globalization, many technologists are trying to update a new development based on automation which works very rigidly, high effectively and within short time period. The progressive invention in auto weighing system is becoming an important task especially because of rising demand of products and declining labor availability in industry. In recent years, in industry the weight of the jobs are checking and then faulty jobs are rejected manually. But nowadays we can check the weight of the object using the automation (using Load cells) technique and faulty jobs rejected using PLC and accurate jobs pass to further process on the conveyor belt. In industry the production speed should be high because demand of the product is more. Nowadays PLC based weighing system is used which increases speed and accuracy. Cost of such system is more as PLC system is used. The system is not reliable and it may collapse. If any of the component fails the system cannot be repaired. So to make it advanced we are designing a new system named as 'Weighing Automation with Data Acquisition System' which will not only measure the quantity of product but also stores the data.

II. SYSTEM ARCHITECTURE

The proposed system consists of load cell, Arduino platform, and memory card. The aim of project is to design a system that will not only weigh an object but also stores the weighed the data. The heart of entire system is Arduino ATmega 2560.The data collected by sensors is store in memory card. The arduino used here has 8KB SRAM and 4KB EEPROM which is sufficient for the storing data. The use of arduino instead of microcontroller is due to its inbuilt memory. Also arduino doesn't require external crystal. The arduino 2560 used here has also the advantage of multiple IO pins.

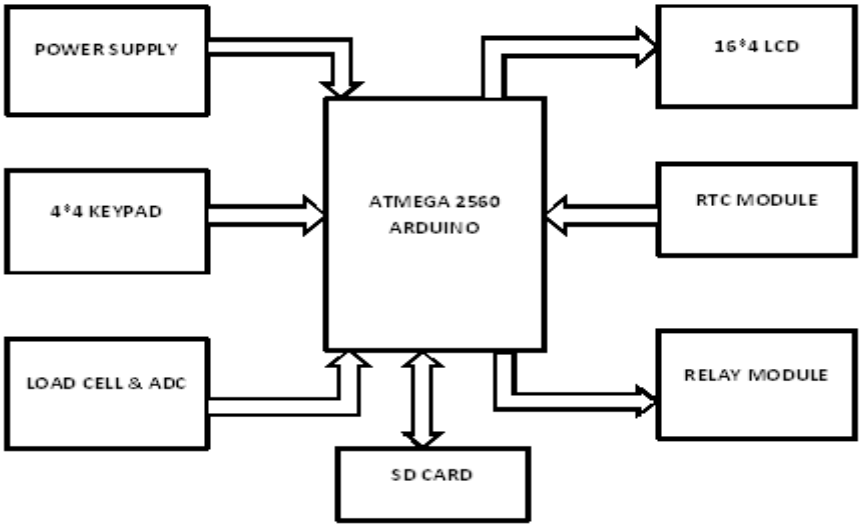
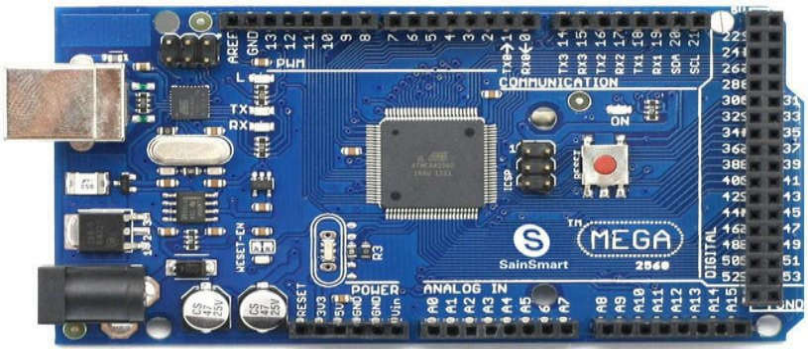


Fig. Block diagram of the system

III. Component Description

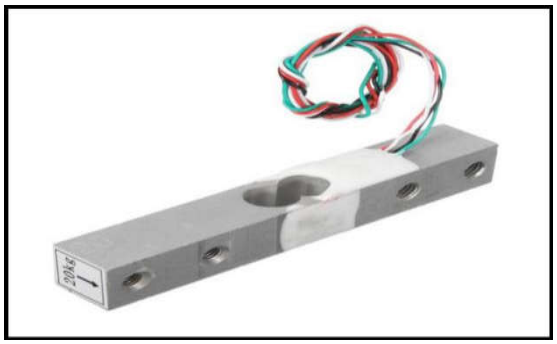
2.1 ARDUINO ATMEGA 2560

The Arduino Mega2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volt. Each of the 54 digital pins on the Mega can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms.



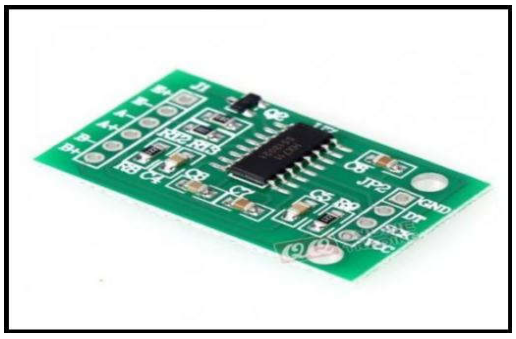
2.2 LOAD CELL

Load cell is a type of transducer which performs the functionality of converting force into an electric output which can be measured. You can find load cell at the heart of any weighing machine or electric scales. This type of transducer is highly accurate which provides user with required information that is difficult to obtain by other technology owing to certain commercial factors. It is basically a device that measures strain and then converts force into electric energy which serves as measurement for scientists and workers. The strain measurement by load cells helps in maintaining integrity of the unit under pressure and protects people and equipment nearby.



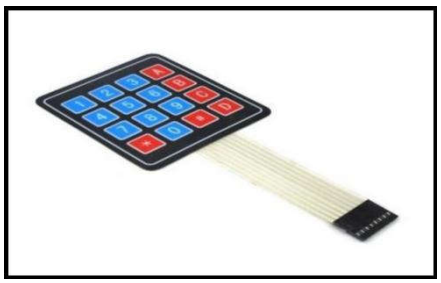
2.3 ADC

Based on Avia Semiconductor's patented technology, HX711 is a precision 24-bit analog-to-digital converter (ADC) designed for weigh scales and industrial control applications to interface directly with a bridge sensor. The input multiplexer selects either Channel A or B differential input to the low-noise programmable gain amplifier (PGA). Channel A can be programmed with a gain of 128 or 64, corresponding to a full-scale differential input voltage of ±20mV or ±40mV respectively, when a 5V supply is connected to AVDD analog power supply pin. Channel B has a fixed gain of 32. On-chip power supply regulator eliminates the need for an external supply regulator to provide analog power for the ADC and the sensor. Clock input is flexible. It can be from an external clock source, a crystal, or the on-chip oscillator that does not require any external component. On-chip power-on-reset circuitry simplifies digital interface initialization. There is no programming needed for the internal registers. All controls to the HX711 are through the pins.



2.4 KEYPAD

The 4*4 matrix keypad usually is used as input in a project. It has 16 keys in total, which means the same input values.



2.5 LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x4 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. Use alphanumeric display for displaying values and controls.

A 16x4 LCD means it can display 16 characters per line and there are 4 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

2.6 RTC

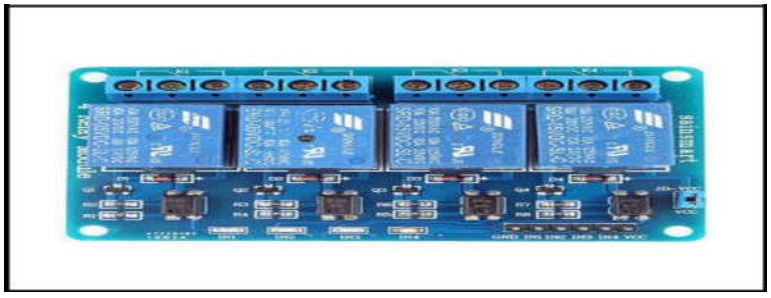
It is a real time clock which displays the date and time. The DS3231 is a low-cost, extremely accurate I2C real-time clock (RTC) with an integrated temperature-compensated crystal oscillator (TCXO) and crystal. The device incorporates a battery input, and maintains accurate timekeeping when main power to the device is interrupted. The integration of the crystal resonator enhances the long-term accuracy of the device as well as reduces the piece-part count in a manufacturing line. The DS3231is available in commercial and industrial temperature ranges, and is offered in a 16-pin, 300-mil SO package. The RTC maintains seconds, minutes, hours, day, date, month, and year information. The date at the end of the month is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with an AM/PM indicator. Two programmable time-of-day alarms and a programmable square-wave output are provided.

2.7 SD CARD

SD card is consisting of two basic semiconductor sections, a 'memory core' and a 'SD card controller'. The 'memory core' is the flash memory region where the actual data of the file is saved. When we format the SD card a file system will be written into this region. Hence this is the region where the file system exists. The 'SD card controller' helps to communicate the 'memory core' with the external devices like microcontrollers. It can respond to certain set of standard SD commands and read or write data from the memory core in for the external device. The data will be stored in the SD card.

2.8 RELAY

Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate. They are often used to interface an electronic circuit (working at a low voltage) to an electrical circuit which works at very high voltage. For example, a relay can make a 5V DC battery circuit to switch a 230V AC mains circuit. Thus a small sensor circuit can drive, say, a fan or an electric bulb.



A **relay switch** can be divided into two parts: input and output. The input section has a coil which generates magnetic field when a small voltage from an electronic circuit is applied to it. This voltage is called the operating voltage. Commonly used relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc. The output section consists of contactors which connect or disconnect mechanically. In a basic relay there are three contactors: normally open (NO), normally closed (NC) and common (COM). At no input state, the COM is connected to NC. When the operating voltage is applied the relay coil gets energized and the COM changes contact to NO. Different relay configurations are available like SPST, SPDT, DPDT etc. which have different number of changeover contacts. By using proper combination of contactors, the electrical circuit can be switched on and off.

III. WORKING

This system is designed to measure the weight of an object automatically and accurately. First user enters the weight of product required using keypad in the system. Then user starts to add product in container. This container is connected to load cell. Load cell continuously weigh the quantity added in container. As product is increasing in quantity the corresponding strain on load cell is increases. This strain is converted into electrical signal like voltage. This analog electrical signal is then converted into digital signal using ADC. As soon as the amount enter by user and measured by load cell is matched, relay switch on which is connected to container and shut the nozzle of container. The weight of product is displayed on LCD. The measured data is store in SD card using RTC module connected to Arduino 2560.The whole process is control and monitor by Arduino 2560 which is the heart of this system.

If we want to take out same quantity repeatedly from container then at first we have to enter the weight quantity and then we have to enter the number of times we want to measure the same quantity. By this way this system can also work in batch process.

CONCLUSION

This system can perform the task of autonomous quality control system used in industrial production and it is most suitable for small scale industries. The production of goods is being increased by automation system. Consequently, it can develop economic growth. The main goal of this paper is to implement "arduino based automatic weighing and data acquisition system". The cost of machine installation is cheap and it is a less time consuming work as compared to manual weighing technique. If properly maintained, it can run for a long period of time. In this machine, arduino has been used to control the overall system by using arduino coding. This is achieved by using sensors, relay switches, load cell, keypad etc. The overall process is more reliable. The operation of the machine is easy. This concept can be used in various industries.

REFERENCE

[1]. *Mechelle Grace Zaragoza and Haeng-Kon Kim. \comparative study of plc and arduino in automated irrigation system". International Journal of Control and Automation, 2017.*

[2]. *Prof. Manish J. Deshmukh Mr. Akshay K. Naphade. \ a review of improved automated conveyor with auto separated system for oil packaging industry". International Journal of Research in Advent Technology, Vol.5, No.2, 2017.*

[3]. *R Schwartz. "automatic weighing-principles, applications & developments". In Proceedings of XVI IMEKO World Congress (Vienna), volume 259. Citeseer, 2000.*

[4]. *Ganesh B Shinde, Vishal P Ghadage, Akshay A Gadhave, and DK Shedge. Plc based auto weighing control system. Int. J. Eng. Tech. Res., 3(3):213{216, 2015.*

[5]. *Yashavant P Kanetkar. Let us C. BPB publications, 2016.*

[6]. *Farid Golnaraghi and Benjamin C Kuo. Automatic control systems. John Wiley & Sons CN6, 1972*