End term Report on

"Portable Weight Measuring Instrument"

Submitted to

Shri Guru Gobind Singhji Institute of Engineering and Technology,

Vishnupuri, Nanded.

For the partial fulfilment for award of the degree of

Bachelor of Technology in Electrical Engineering

Submitted by

Mr. Vishal Nandanwar **(2014BEL009)**

Mr. Sachin Chavan **(2014BEL030)**

Mr. Mohammed Kashif **(2014BEL002)**

Under Guidance Of

Mr. R. S. Ankushe

Department of Electrical Engineering,

Shri Guru Gobind Singhji Institute of Engineering and Technology,

Vishnupuri, Nanded- 431606

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Project Guide	**Head of Department**	**Mini project co-ordinator**
Mr. R. S. Ankushe	Dr. B. M. Patre	Mr. R. V. Pawar
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Vishal Gajanan Nandanwar (2014BEL009)
Sachin Wamanrao Chavan (2015BEL030)
Mohammed Kashif (2014BEL002)

DECLARATION

We, Vishal Gajanan Nandanwar , Sachin Wamanrao Chavan , and Mohammed Kashif the students of Bachelor of Technology (Electrical), Shri Guru Gobind Singhji Institute Of Engineering and Technology, Vishnupuri, Nanded (431606) hereby declare that the work presented in this Mini Project is an authentic record of our own and has been carried out taking care of Engineering Ethics under the guidance of Mr. R.S. Ankushe.

Vishal Gajanan Nandanwar	**(2014BEL009)**
Sachin Wamanrao Chavan	**(2015BEL030)**
Mohammed Kashif	**(2014BEL002)**

Actual Model of Instrument

CHAPTER 1

ABSTRACT

The measurement device can be seen as a system measuring quantity of substance and converting into output measurement result which can be express using numbers using plenty of technologies like conversion, comparison, processing etc. However due to transfer product from one place to another, lot of human efforts and time get spent. Now a days in this busy life we have to do more and more work in lesser time, also various weight measuring instrument requires lot of space as well as these are not easy to move. Some weighing instrument doesn’t give accurate result.

In this Project we are compacting the digital measuring system and fitting this system directly into the container in which we take product in some quantity for measurement. By using load cell and electronic circuit board considering all components fitted into container, we can directly measure weight of product while it will be taken in container. There is no need to take product in container and then place container on weight measuring instrument separately. Weight of product get measured in container itself and it displays on the digital display along with its market price. Also we can set the weight manually which has to be measure and if it exceeds the input weight beep sound indicating more the substance in container.

It will result in simple structure and small size weight measuring instrument. Therefore it is cheaper than other heavy electronic weighing machine. Its commercial production is easy for marketing. It will be light in weight as well as handy, so it is very easy to use. It requires lesser space, also much time will be saved.

INTRODUCTION

Today we have number of weight measuring instruments, mostly they are of two types,
1) Conventional Measuring Instruments.
2) Digital Measuring Instruments.

Conventional Weight Measuring Instruments have very simple structure. As we see in villages people still uses these instruments for weight measurement of wheat, jowar and rice by using special product with some standard weight stone of 0.5kg, 1kg, 2kg, 5 kg etc. These instrument are not easy to use also doesn't give proper accuracy. These instruments are quite heavy because they have metal body.

To get more accuracy, an advanced version of weight measuring instrument is made called Electronic Weighing Machine (Digital Weighing instrument). These instrument are easy to use and give high accuracy. These instrument are quite costly as compared to conventional weight measuring instrument. Digital measurement system are easy to move, but product which we have to measure is necessary to take into container then it has to weight. These process of taking product every time to weighing machine consumes time and reduce the rate of weight measurement of number of product. So there is improvement needed in it because time is lost while measuring the weight of substance.

Now there is need of making such Weight Measuring Instrument which is digital also quite handy, time saving and small in size, so that it can be easily move from one place to another place , which gives high accuracy results, light in weight, require less maintenance, easy to use for customer.

In these project we are making same instrument as requirement described, which is combination of both conventional (handy and small in size) and digital weighing machine (accuracy in result).

OBJECTIVE OF WORK:

1. Making complicated weight measuring instrument into simpler one.
2. Making portable weight measuring instrument.
3. Study of calibration.
4. Software programming.
5. Hardware implementation.

CHAPTER 2

2.1 System Operation:

In this measurement system object which has to be measure is place on the load cell. The load cell experience the sheer force which causes load cell to expand and compress. Hence resistance of the stain gauge changes which is place as Wheatstone bridge fashion. Load cell generates weak analog signals which need to amplify since small changes can't detected from it. Amplifier is used to amplify the weak signals. Since signals are analog which need to convert digital as microcontroller can read only Digital signal.

This measurement system has given the extra facility that is can also calculate the price of the substance which has to be measure by manually setting the price per kg of the substance. Also we can set the required weight of the substance manually and if weight exceeds the given weight it makes beep sound so we do not need to notice how much quantity we taken. The keypad is given in the system for manual input. The input data is process by the controller and out is displayed on the Display.

For Digital output Display is given in the system. For the operation of the display, Display driver is needed. It is special IC which used to convert digital signals into encoded signals needed for LCD display. It is recommended to display the following quantities

a) Weight in Kg.
b) Price of total quantity.
c) Manual input Weight.

The whole system is powered by battery which is removable or rechargeable as per system requirement.

2.2 Block Diagram:

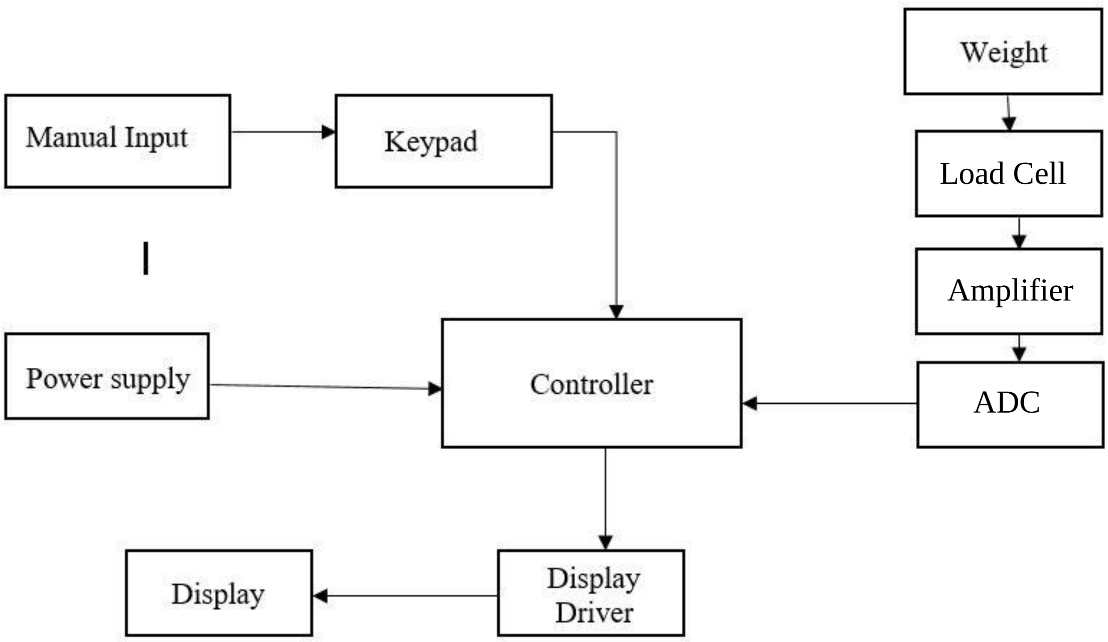

Fig.1 System Block Diagram

2.3 Block Diagram Explanation:

Microcontroller is used as controlling device which is fed by 9v power supply. From Arduino power supply is given to load cell, display and keypad. Since load cell gives weak signal after putting weight on it, which does not proper for its working. We used an amplifier circuit to amplify and strengthen the signal that is further given to Arduino through ADC. The display driver is used for digital display so that output generated from Arduino show on it. To enter the price per kg of measuring weight, keypad is connected.so that we get actual price of measuring weight also.

CHAPTER 3

3.1 Control of System:

The Handy Weight Measuring Instrument use a load cell to measure weight of specific item. Load cell is transducer which measure pressure applied on it and proportionally generate very small voltage drop across its register.

To amplify this electric signal (voltage drop) one amplifier is connected in it. Then it's necessary to convert these signal analogue to digital so that aurduino can read the signal .For this we have connected one Analogue to Digital converter (ADC). Arduino gets the signal from ADC and Process on it. Output generated from arduino is sent to digital display which we are placed on outside of instrument. Keypad is also used in it so that we can give input price to specific item for 1kg, according to this we get actual price for weight measured of specific item.

3.2 Control Diagram of System:

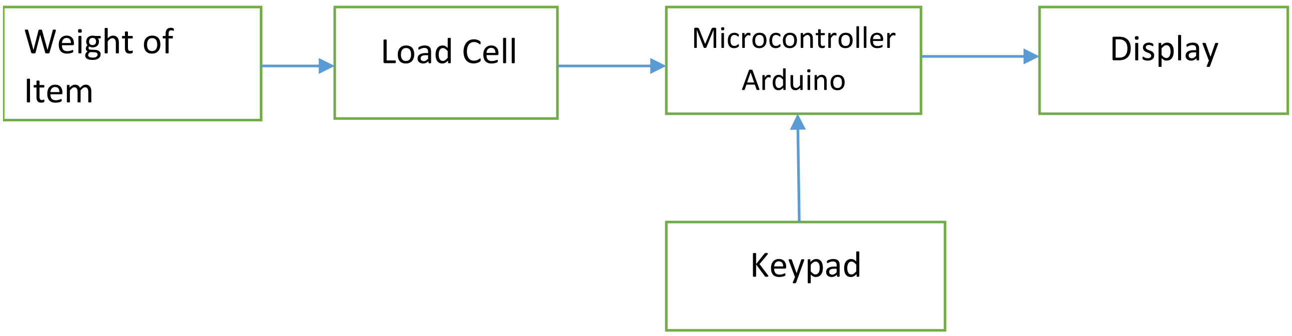

Fig.2 Control Diagram of System

The control diagram of system is given above which shows description of working process. This is open loop system which shows system's simplicity and stability in its work. Weight of item which we put in instrument for measurement is input to system. Load cell receives this signal and send it in electric form to arduino through ADC. As arduino receives digital signal and process on it. Another signal is sent to arduino through keypad that is price per kg of measuring item. After this arduino generate output and send it to LCD display which shows final output in terms of weight and price. Our system is open loop system so it cant send feedback signal to input.

CHAPTER 4

4.1 Circuit Diagram of System Using Arduino Pro Mini:

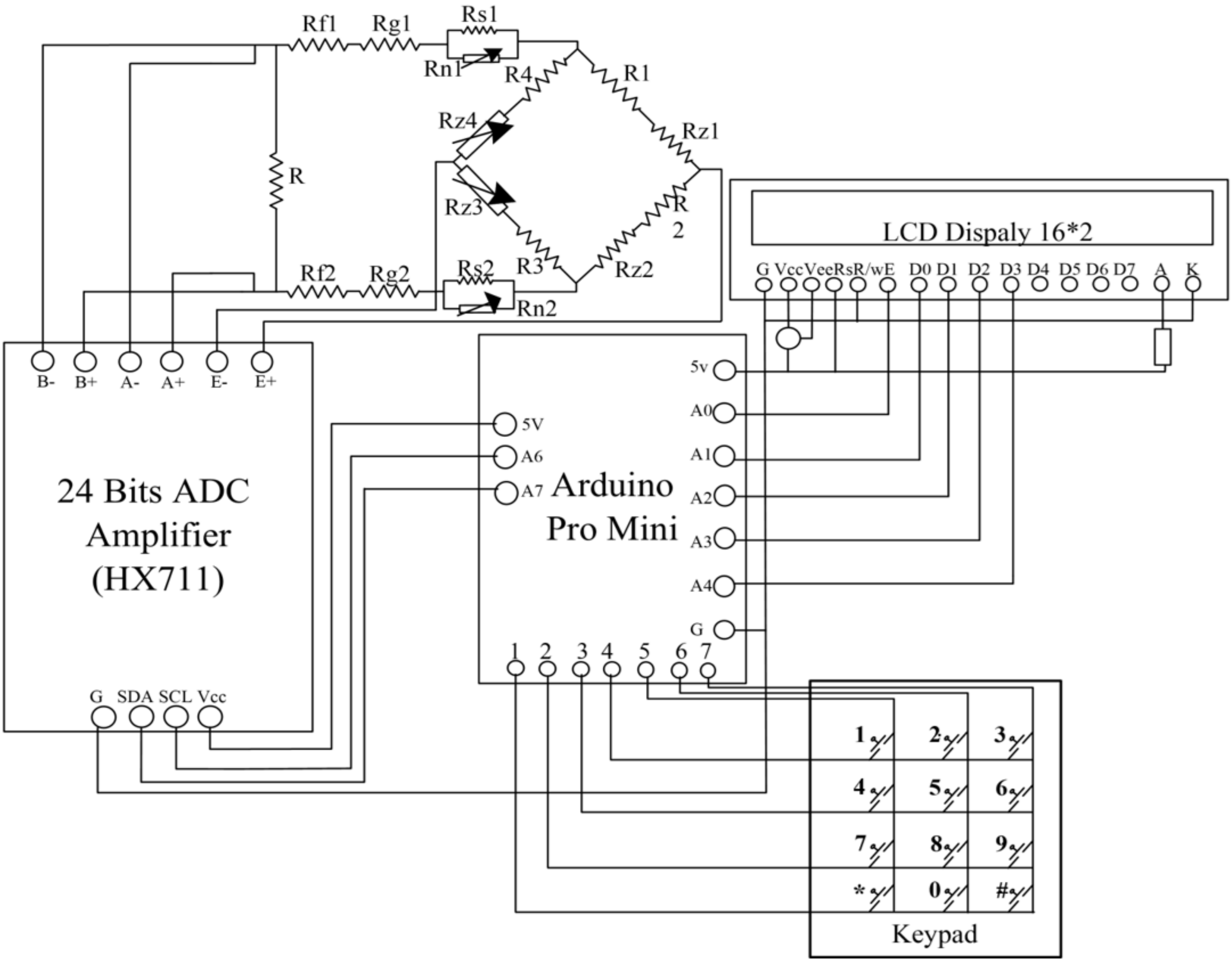

Fig.3 Circuit Diagram Using Arduino Pro Mini

- **Description:**

Figure 3 shows the whole circuit diagram of System using Arduino pro Mini. The microcontroller used in this system is Arduino Pro Mini, which provided with 9V power supply. The controller feeding 5V supply to Amplifier Hx711, LCD Display. The load cell gives very weak analog signal but microcontroller is capable of only reading digital signal. The Amplifier Hx711 Amplifies the load cell's weak signal and converted this into digital signal using ADC (Analog to Digital converter).

The voltage output obtained through the load cell is very low i.e. in few millivolts. Small change in voltage is sometimes is nondetectable causing faulty reading or decrease the resolution of the system. The microcontroller using has inbuilt ADC converter so that the analog readings obtain through load cell is directly converted into digital value. The microcontroller available has 10 bit

ADC and obtain the output voltage in 1024 steps. (2^{10}=1024) i.e. the resolution of load becomes when it is excited by 5v is given by

$$Resolution = \frac{5v\ (Ve)}{1024\ (step\ size)}$$

= 4.8 millivolt (mV)

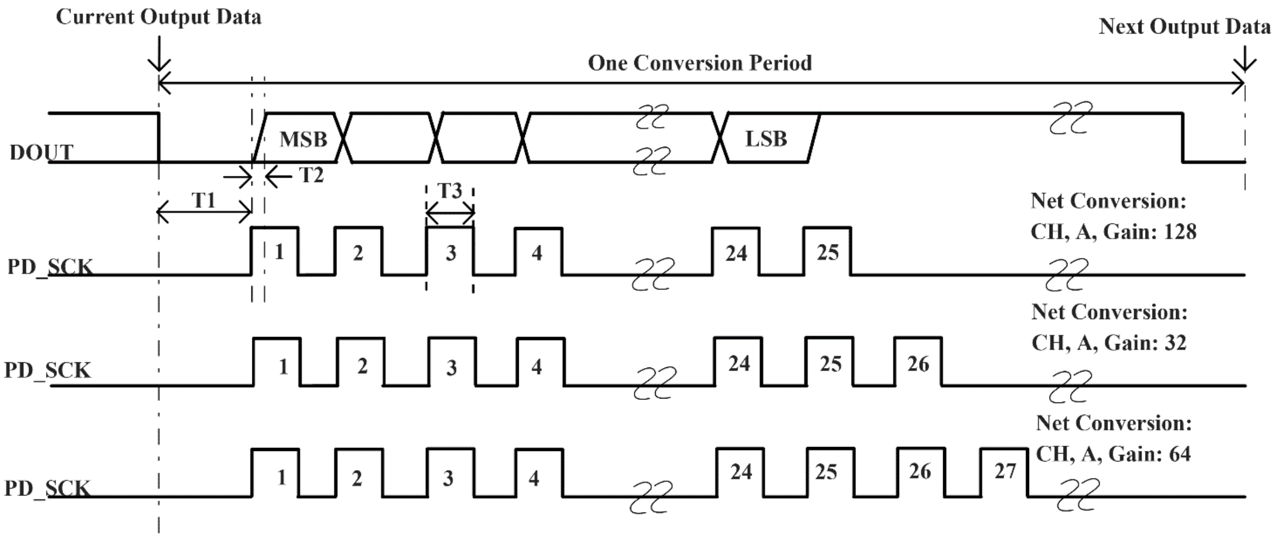

Fig.4 Data output, Input and gain selection timing and control

This resolution is very small when it is deformed by small weight and it is not detectable so higher bit ADC is required for this purpose.

Pin PD_SCK and DOUT are used for data retrieval, input selection, gain selection and power down controls, when output data is not ready for retrieval, digital output pin DOUT is high. Serial clock input PD_SCK should be low. When DOUT goes to low, it indicates data is ready for retrieval. By applying 25~27 positive clock pulses at the PD_SCK pin, data is shifted out from the DOUT output pin. Each PD_SCK pulse shifts out one bit, starting with the MSB bit first, until all 24 bits are shifted out. The 25th pulse at PD_SCK input will pull DOUT pin back to high. The data retrieved from Hx711 is manipulated by Arduino Pro Mini is given to the LCD display. We can set price for different items/grians by using Keypad.

4.2 Proteus Simulation Output

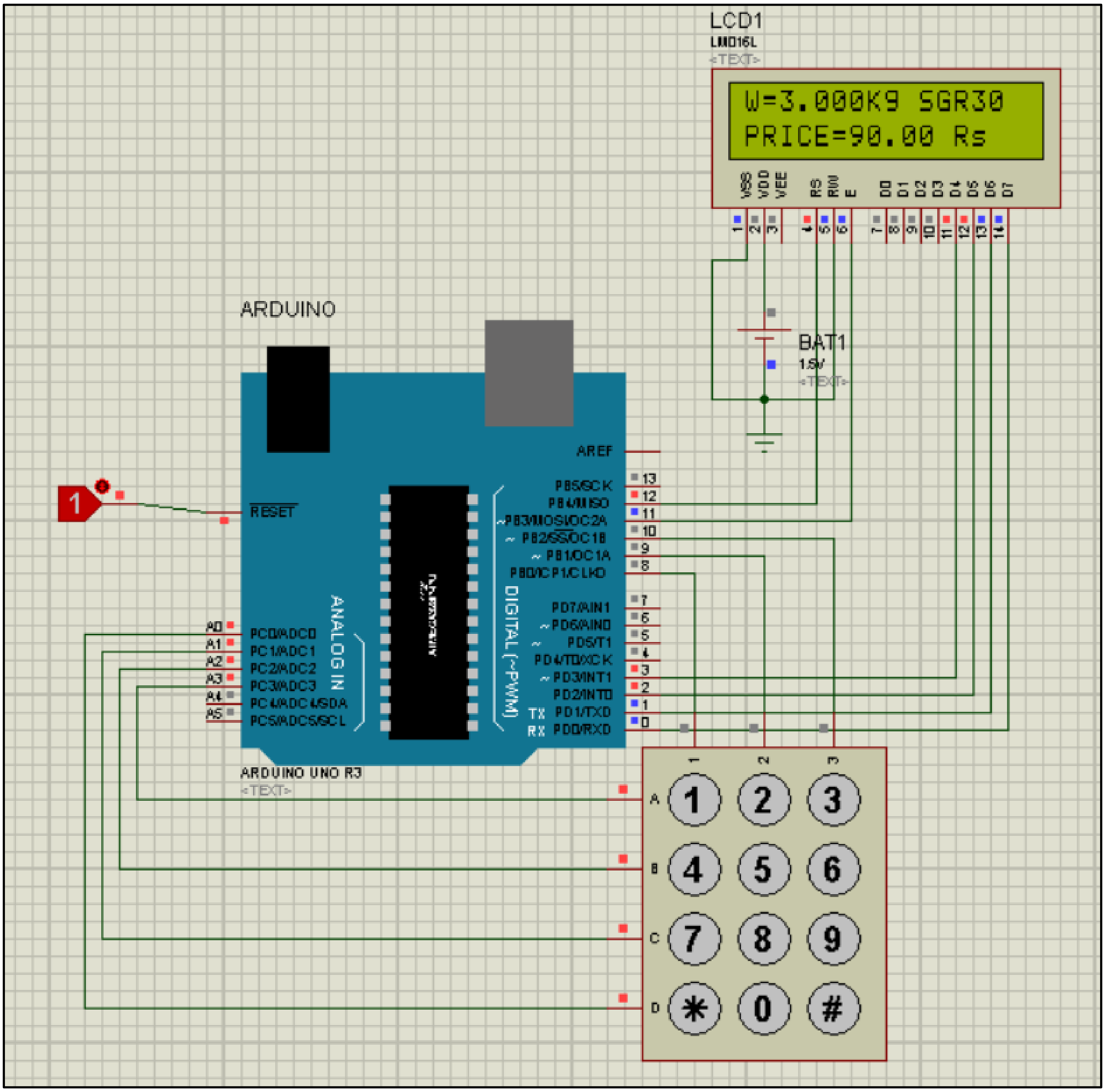

Fig.5 Protues Circuit Diagram

4.3 MATLAB simulation

The simulation results plotted in MATLAB are exactly same as the results obtain in hardware implementation.

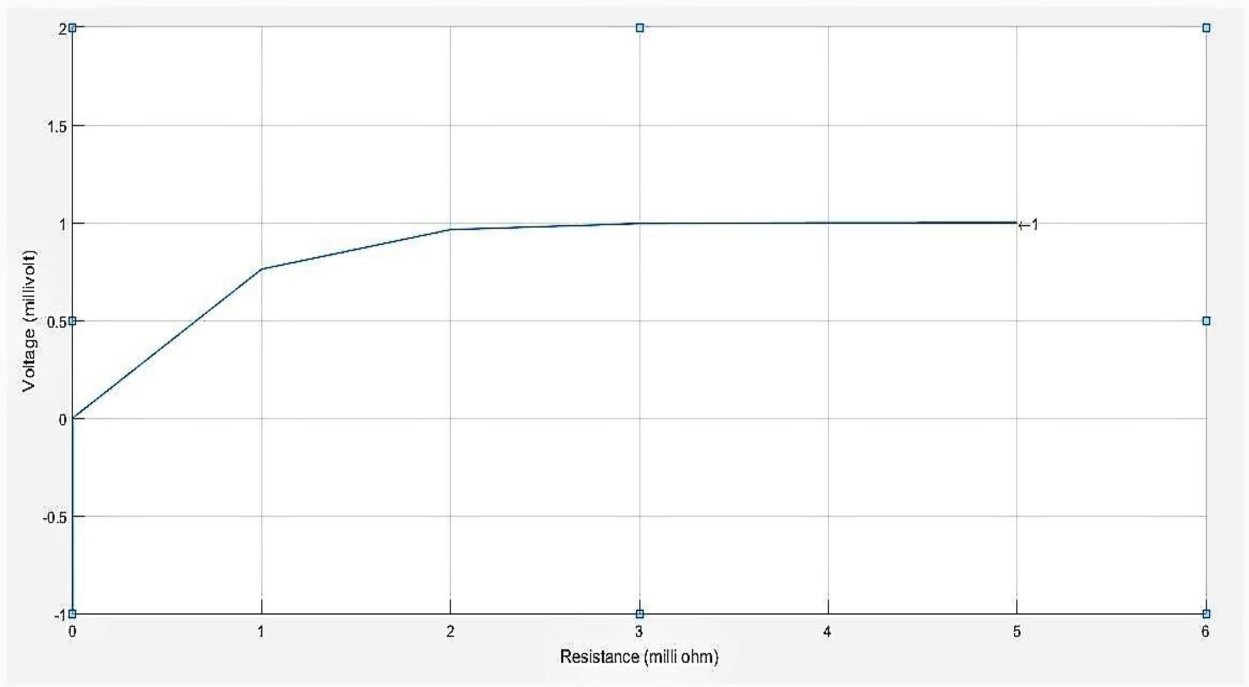

Fig.6 Graph of resistance vs Volatge.

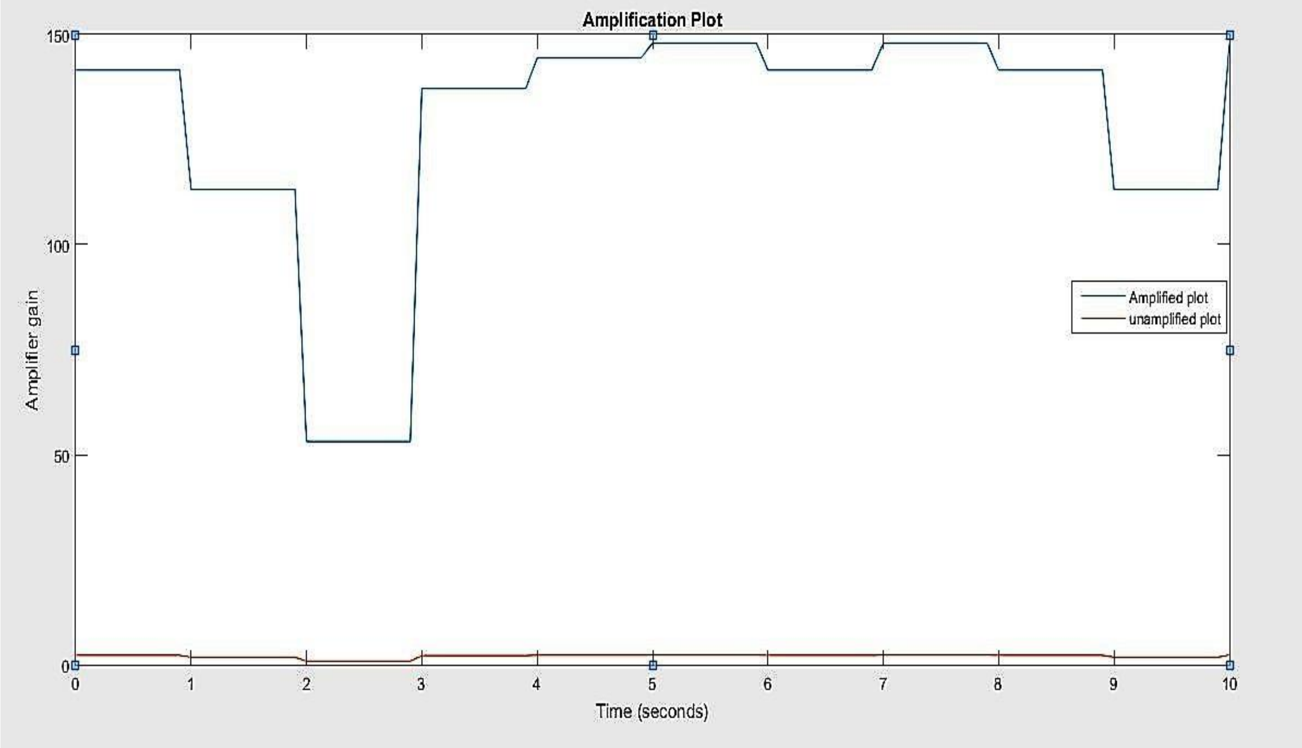

Fig.7 Graph of amplifies vs unumplified output

In first graph voltage vs. resistance is plotted. The resistance of load cell is increase up to specific limit i.e. up to its elasticity hence maximum voltage obtain in load cell is also fix. The resistance and voltages are in Millis so the maximum resistance of load cell resistors after applying strain on maximum 3 kg capacity load cell is obtain 5 milliohm and voltage obtain across the load cell is 1mV. The graph is quit increasing up to these value, after that load cell goes out of service.

In second graph,The graph with amplified and unamplified output of load cell is presented here. The amplified output is obtain using load cell amplifier (HX711 IC) which has inbuilt ADC. The gain of amplified system is very high and precise, even very small change in voltage is also interpreted, leading towards very precise weight measurement system.

The change in load cell resistance vs total output obtain in this case is in analog form.

CHAPTER 5

Components Used:

1. Load cell

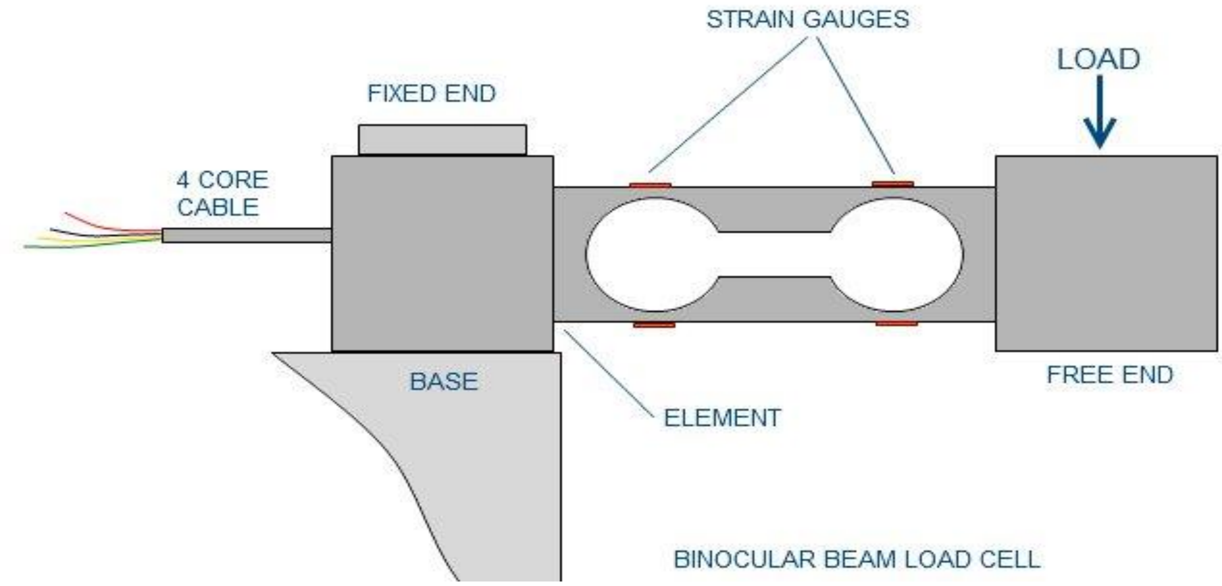

Fig .8 Load Cell

A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. The various types of load cells include hydraulic load cells, pneumatic load cells and strain gauge load cells. the force being sensed deforms a strain gauge. The strain gauge measures the deformation (strain) as a change in electrical resistance, which is a measure of the strain and hence the applied forces. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. High resolution ADC, typically 24-bit, can be used to amplify the output.

The load cell are of different types these are of following

a) Shear beam, a straight block of material fixed on one end and loaded on the other.
b) Double-ended shear beam, a straight block of material fixed at both ends and loaded in the centre.
c) Compression load cell, a block of material designed to be loaded at one point or area in compression.
d) S-type load cell, a S-shaped block of material that can be used in both compression and tension (load links and tension load cells are designed for tension only).

- Wheatstone bridge configuration of load cell:

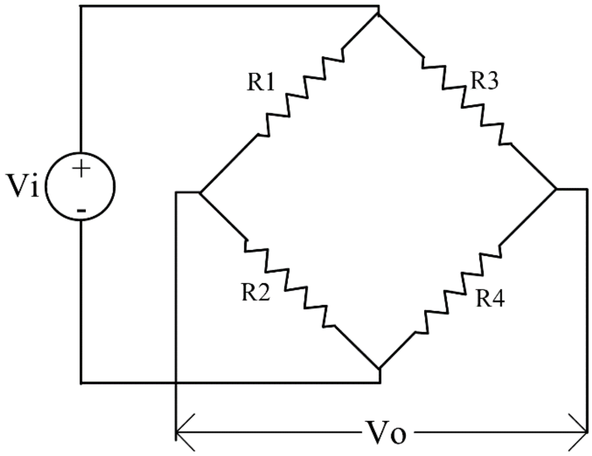

Fig.9 Ckt diagram of wheatstone bridge

Wheatstone bridge amplify the voltage across the resistor in considerable amount, that means small voltage drop across the resistance is amplified across the two terminals of bridge. The voltage V_{in} is given to the two diagonally opposite terminals and and output voltage V_{out} is obtained through diagonally opposite terminals of applied voltage. The voltage V_{out} through resistor branches is zero when load on load cell is zero, hence initially bridge is balance. After loading condition V_{out} at two branches is given as

$$Vout = \left(\frac{R2}{R1 + R2} - \frac{R3}{R3 + R4}\right)Vin$$

The actual configuration of load cell consist of 4 to 6 wires. The 4 wire load cell has temperature compensating system in it. Load cell is manufacture considering the wire length is caliberated and compansated. The 6 wire load cell has not the temperature compansting network in it, instead it has given 2 extra wires. These sense line act as feedback to the voltage source connected to the sense terminal of load cell. The advantage of this system that we can extend the length of wire to any extend. The load cell perform within the specifiation limit if these sense lines are not used.

- The Complete Circuit diagram of precise load cell

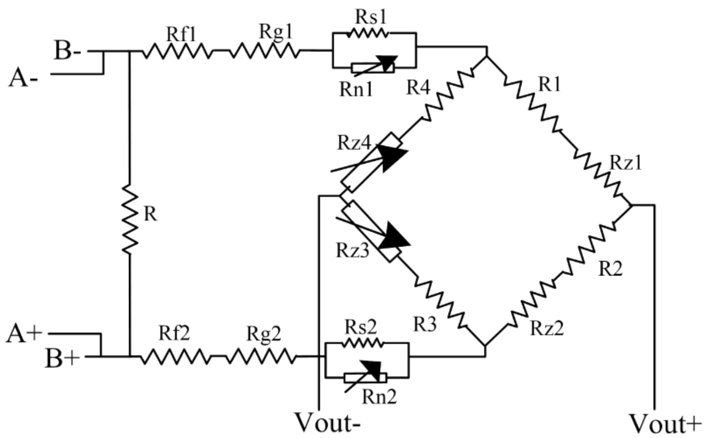

Fig.10 Ckt diagram of Precise Load cell

The output signal of load cell is given by

$$Vo = \left(\frac{Ld + La}{Emax}\right)Ve$$

Where,

V_0 = Output voltage (mV)

L_d = Dead load on load cell

La= Applied load

E_{max}= Load cell capacity

V_e = Exitation voltage

Load cell is transducer which uses electrical and mechanical property of metal which changes its dimension when applied to strain, causes elastic deformation and change in resistance. The strain gauge type load cell is based on working of Wheatstone bridge network in which change in resistance causes the change in potential difference along its diagonally opposite terminals which is directly proportional to applied force[2-3][7]. It is made up of very fine wires making it grid structure which is glue to metallic elastic body of load cell. The strain or force applied on load cell tends to deform the load cell causing change in resistance of strain gauge will produce small increment and decrement of resistance of strain gauge according to compression and the expansion. This results will add extra resistance (ΔR) to its nominal resistance value (Rg). This resistance change is given by

Change in resistance = (Gf *applied strain * Rg)

Where,

Gf : gauge factor.

Rg : nominal resistance

This resistance change is very small compare to nominal resistance and is magnified by resistive imbalance produced in Wheatstone bridge. When force on load cell is zero, the four resistive gauges are at same ohmic value. (i.e. R1 = R2 = R3 = R4 = Rg ohm).

When load cell is loaded, the balance state get disturbed and the value of the resistances changes by factor (ΔR). The overall resistances value becomes (R1 = Rg - ΔR , R2 = Rg +Δ R, R3 = Rg - ΔR, R4 = Rg + ΔR) as compression force act on R1, R3 and expansion force act on R2, R4. The Wheatstone bridge is amplifier in four resistance system and find the exact resistance change using voltage change.

2. Load Cell Amplifier (HX711)

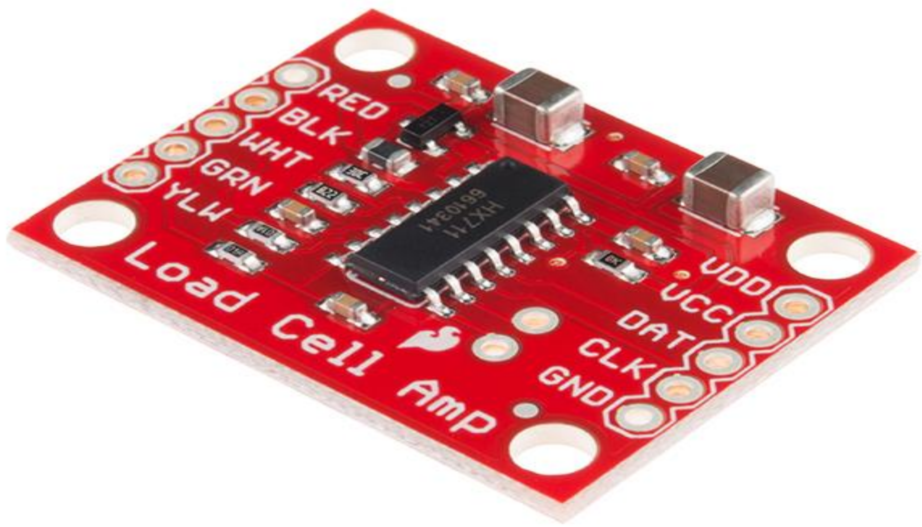

Fig.11 Load Cell Amplifier (HX711)

The Load Cell Amplifier is a small breakout board for the HX711 IC that allows you to easily read load cells to measure weight. By connecting the amplifier to microcontroller it will be able to read the changes in the resistance of the load cell, and with some calibration to get very accurate weight measurements. This can be handy for creating industrial scale, process control or simple presence detection.

This version of the Load Cell Amplifier features a few changes that specifically needed for high accuracy. It has separated the analog and digital supply, as well as added a 3.3uH inductor and a 0.1uF filter capacitor for digital supply.

The HX711 uses a two-wire interface (Clock and Data) for communication. Any microcontroller's GPIO pins should work, and numerous libraries have been written, making it easy to read data from the HX711. Load cells use a four-wire Wheatstone bridge configuration to connect to the HX711. These are commonly colored RED, BLK, WHT, GRN and YLW. Each color corresponds to the conventional color coding of load cells:

- Red (Excitation+ or VCC)
- Black (Excitation- or GND)
- White (Amplifier+, Signal+ or Output+)
- Green (A-, S- or O-)
- Yellow (Shield)

The YLW pin acts as an optional input that is not hooked up to the strain gauge but is utilized to ground and shield against outside EMI (electromagnetic interference).

3. Controller (Arduino Pro Mini)

The original, true-blue Arduino is open-source hardware, which means anyone is free to download the design files and spin their own version of the popular development board. SparkFun has jumped on this opportunity and created all sorts of Arduino variants, each with their own unique features, dimensions, and applications. Now one of those variants has landed in your hands; congratulations! It's a wild world out there in microcontroller-land, and you're about to take your first step away from the wonderful – though sometimes stifling – simplicity of the Arudino Pro Mini.

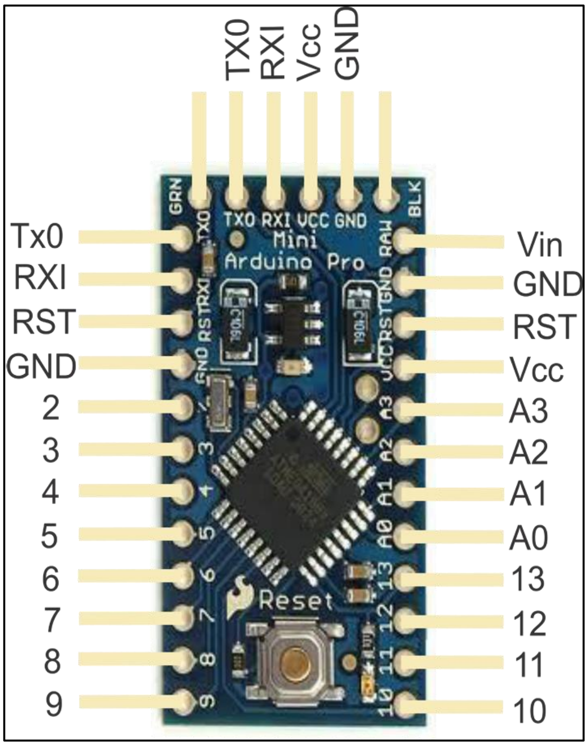

Fig.12 Arduino Pro Mini

The Arduino Pro Mini is an ATmega168 based microcontroller board. The board comes with built-in arduino bootloader. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 8 analog inputs, an on-board resonator, a reset button, and holes for mounting pin headers. The board can be connected to the PC using USB port and the board can runs on USB power. There are two version of the Pro Mini. One runs at 3.3V and 8 MHz, the other at 5V and 16 MHz.

Table No.01 Arduino Pro Mini Details

Arduino Pro Mini DETAILS	
Microcontroller	ATmega168
Operating Voltage	3.3V or 5V
Input Voltage	3.35 -12 V (3.3V model) or 5 - 12 V (5V model)
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 mA
Flash Memory	16 KB (of which 2 KB used by bootloader)
SRAM	1 KB
EEPROM	512 bytes
Clock Speed	8 MHz (3.3V model) or 16 MHz (5V model)

Table No.02 Arduino Pro Mini Pinout

Arduino Pro Mini PINOUT	
RAW	For supplying a raw (regulated) voltage to the board
VCC	The regulated 3.3 or 5 volt supply
GND	Ground pins
RX	Used to receive TTL serial data
TX	Used to transmit TTL serial data
2 and 3	Digital I/O pins. These pins can also be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value
3, 5, 6, 9, 10, and 11	Digital I/O pins. They can also be configured to provide 8-bit PWM output
10, 11, 12 and 13	Digital I/O pins. They can also be configured as SPI pins; 10 - (SS), 11 - (MOSI), 12 - (MISO) and 13 - (SCK)
A0 to A3	Analog input pins
A4 and A5.	Analog input pins. They can also be used as IIC pins; A4 - (SDA) and A5 – (SCL).
A6 and A7	Analog input pins
Reset	The microcontroller can be reset by bringing this pin low

4. Keypad

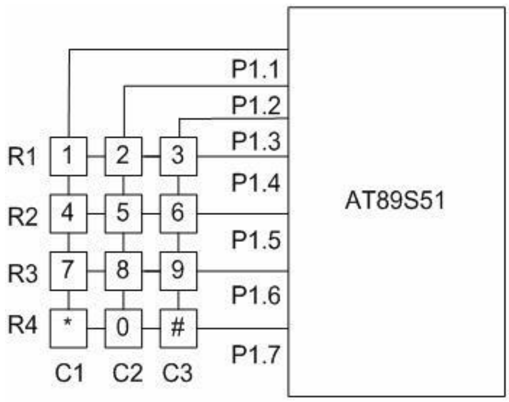

Fig.13 Keypad

A **keypad** is a set of buttons arranged in a block or "pad" which bear digits, symbols or alphabetical letters. Pads mostly containing numbers are called a **numeric keypad**. At the lowest level, keyboards are organized in a matrix of rows and columns. The CPU accesses both rows and column through ports; therefore, with a port of microcontroller, a 4X3 matrix of keys can be connected. When a key pressed, a row and column make a connection; otherwise, there is no connection between row and column.

Someone can not press two key at the same time. There is time different between press a key with another key. 'KeyPressed' indicates there is a key pressed in this time. Before leave the entire subroutine, if 'KeyPressed' has been set, the microcontroller set the variable 'KeyAlreadyPressed'. This variable will not be cleared until this subroutine detect that there is no key pressed. So, if press more than two keys,only the first key will be read. To see if any key is pressed, the columns are scanned over in an infinite loop until one of them has 0 on it.

Output Data				Input Data			Key Pressed
R1	R2	R3	R4	C1	C2	C3	
0	1	1	1	0	1	1	1
0	1	1	1	1	0	1	2
0	1	1	1	1	1	0	3
1	0	1	1	0	1	1	4
1	0	1	1	1	0	1	5
1	0	1	1	1	1	0	6
1	1	0	1	0	1	1	7
1	1	0	1	1	0	1	8
1	1	0	1	1	1	0	9
1	1	1	0	0	1	1	*
1	1	1	0	1	0	1	0
1	1	1	0	1	1	0	#

Table.1 Truth Table of Keypad

5. LCD Display

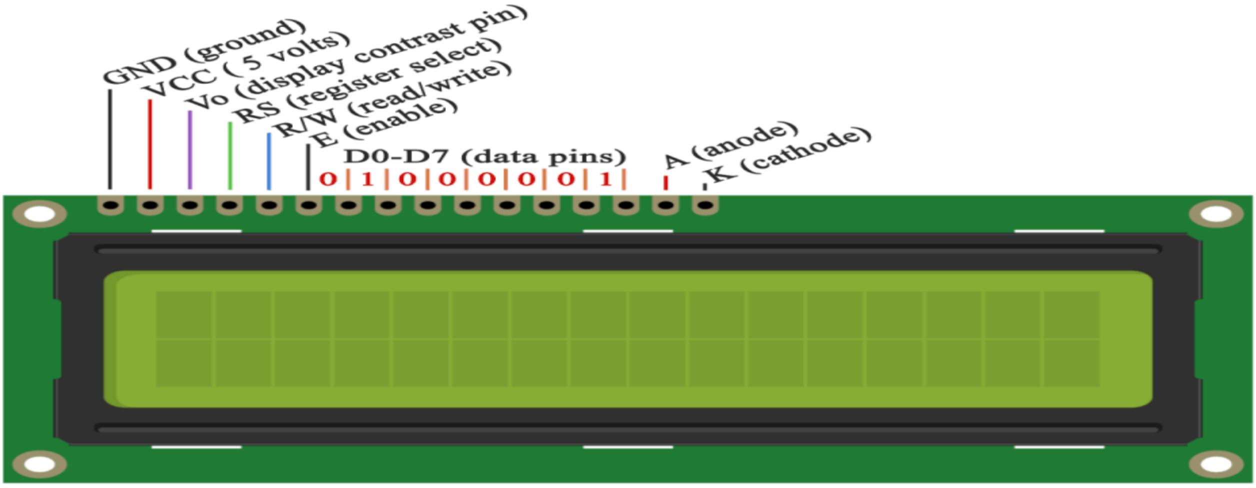

Fig.14 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 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.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Table.2 Pin numbering of LCD Display

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.

6. Battery

Fig.15 Battery

The nine-volt battery, or 9-volt battery, in its most common form was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in walkie talkies, clocks and smoke detectors.

The nine-volt battery format is commonly available in primary carbon-zinc and alkaline chemistry, in primary lithium iron di-sulphide, and in rechargeable form in nickel-cadmium, nickel-metal hydride and lithium-ion. Mercury-oxide batteries of this format, once common, have not been manufactured in many years due to their mercury content. Inside an alkaline or carbon-zinc 9-volt battery there are six cylindrical or flat cells connected in series. Some brands use welded tabs internally to attach to the cells, others press foil strips against the ends of the cells.

Rechargeable nickel–cadmium (NiCd) and Nickel-metal hydride (NiMH) batteries of nominal 9V rating have between six and eight 1.2 volt cells. Lithium ion versions typically use two cells (3.7-4.2V nominal each). There are also lithium polymer and low self-discharge NiMH versions.

Mercury batteries were formerly made in this size. They had higher capacity than the then-standard carbon-zinc types, a nominal voltage of 8.4 volts, and very stable voltage. Once used in photographic and measuring instruments or long-life applications, they are no longer manufactured as mercury is an environmental pollutant.

Alkaline and lithium batteries self-discharge much more slowly than the older zinc-carbon type. An alkaline battery that is not used, or used in extremely low current applications such as backup, can be expected to last for approximately 6 years.

7. Jumper Wires:

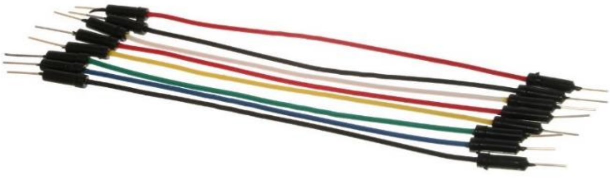

Fig.16 Jumper Wires

A jump wire (also known as jumper, jumper wire, jumper cable, DuPont wire, or DuPont cable – named for one manufacturer of them) is an electrical wire or group of them in a cable with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Jumper pins (points to be connected by the jumper) are arranged in groups called *jumper blocks*, each group having at least one pair of contact points. An appropriately sized conductive sleeve called a jumper, or more technically, a shunt jumper, is slipped over the pins to complete the circuit.

8. SPST Switch

Fig.17 SPST Switch

A single-pole, single-throw (**SPST**) switch is as simple as it gets. It’s got one output and one input. The switch will either be closed or completely disconnected. SPSTs are perfect for on-off switching. They’re also a very common form of momentary switches. SPST switches should only require **two terminals**. We can easily on or off instrument to save battery power.

Fig.16 SPST Switch

CHAPTER 6

6.1 FLOWCHART:

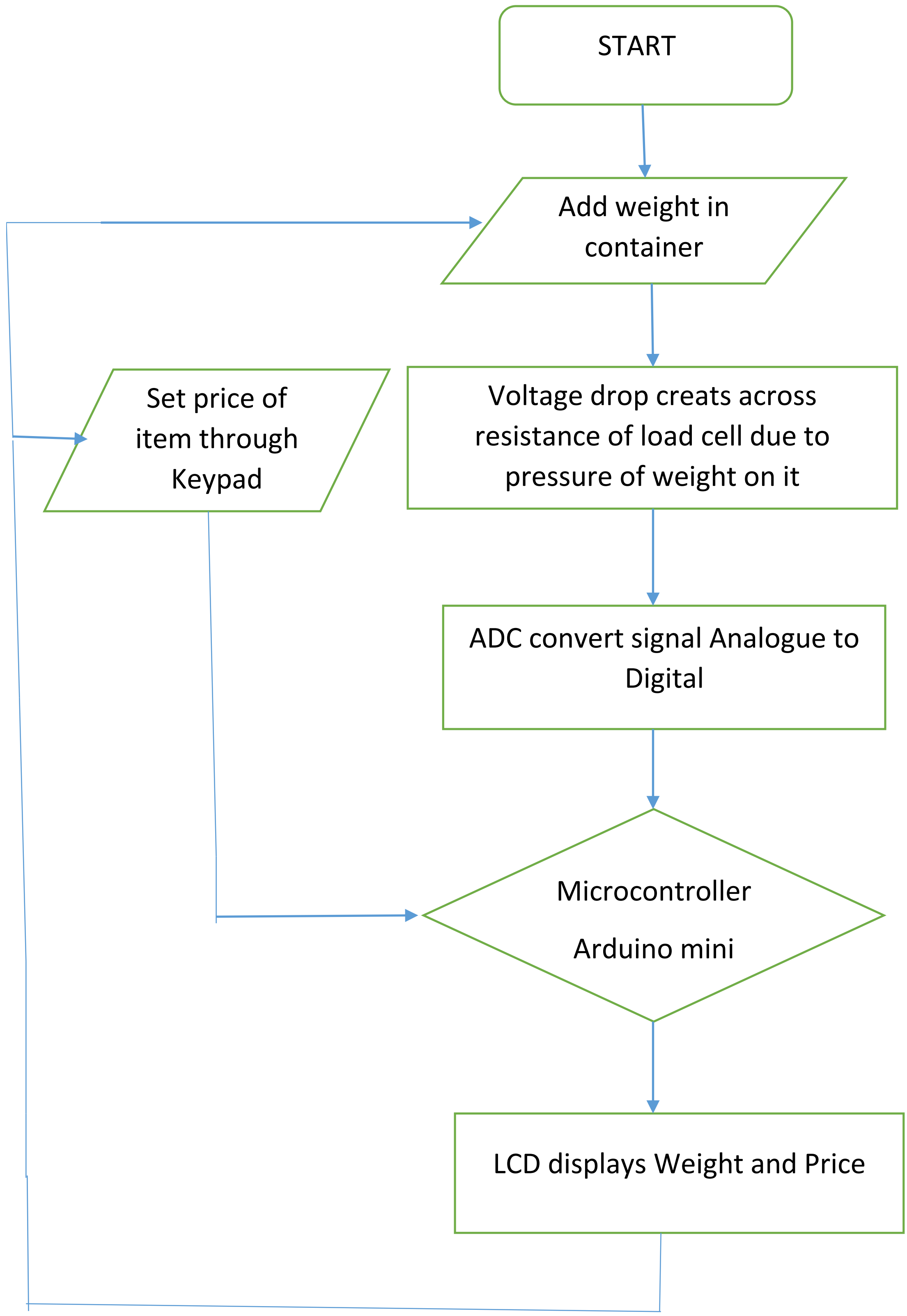

Fig.18 Flow chart of System

Working of Instrument

Visual interface of system:

• The weight and price of grains is continuously display on the LCD, total price display depending on previously entered price. The loop goes on displaying weight & price continuously until user selects mode.

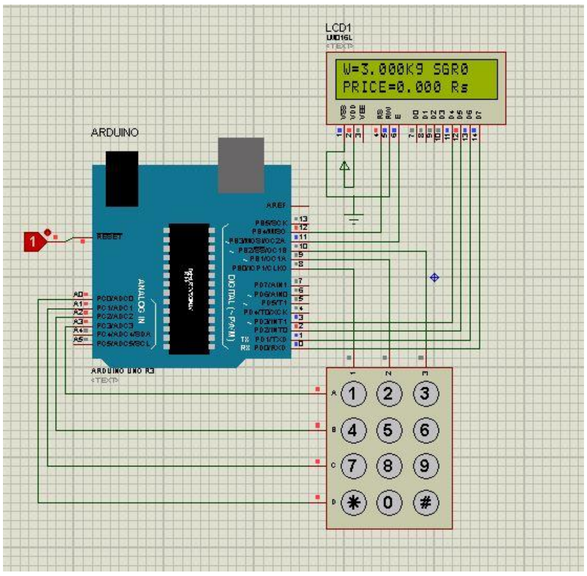

Fig.19 Step 1st

Here the weight of Sugar i.e 3Kg is displaying with its initial price Rs. 00 and total price of 3 Kg of Sugar is Rs. 00.

• Modes are nothing but the type of grain which is to be weight. The keypad buttons are allotted to choose the type of grain under measurement as shown in figure.

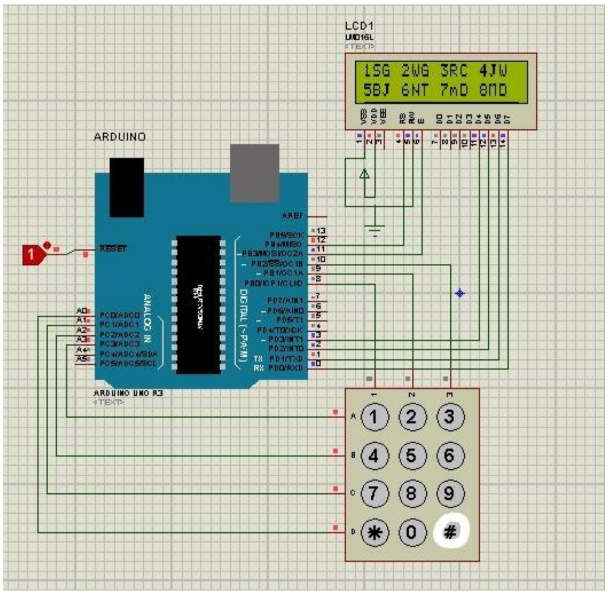

Fig.20 Step 2nd

• In the market, the prices of grains changes day by day, so it is most important to change the price. The price of grain can be change by pressing pond sign ‘#’ and then the number to which that grain is assigned (whose price we want to change) is press. Now enter the current market price.

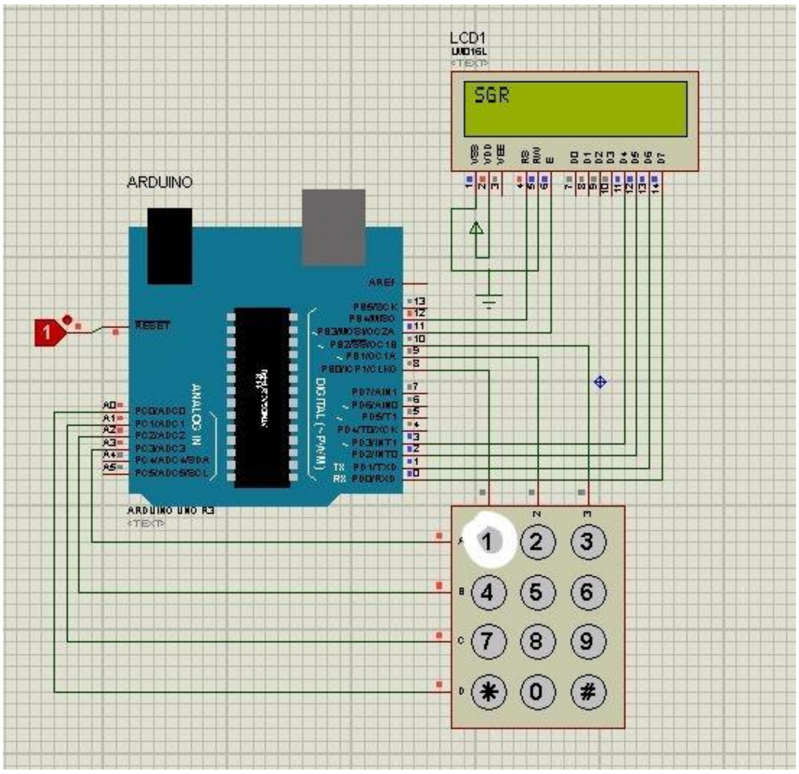

Fig.21 Step 3rd

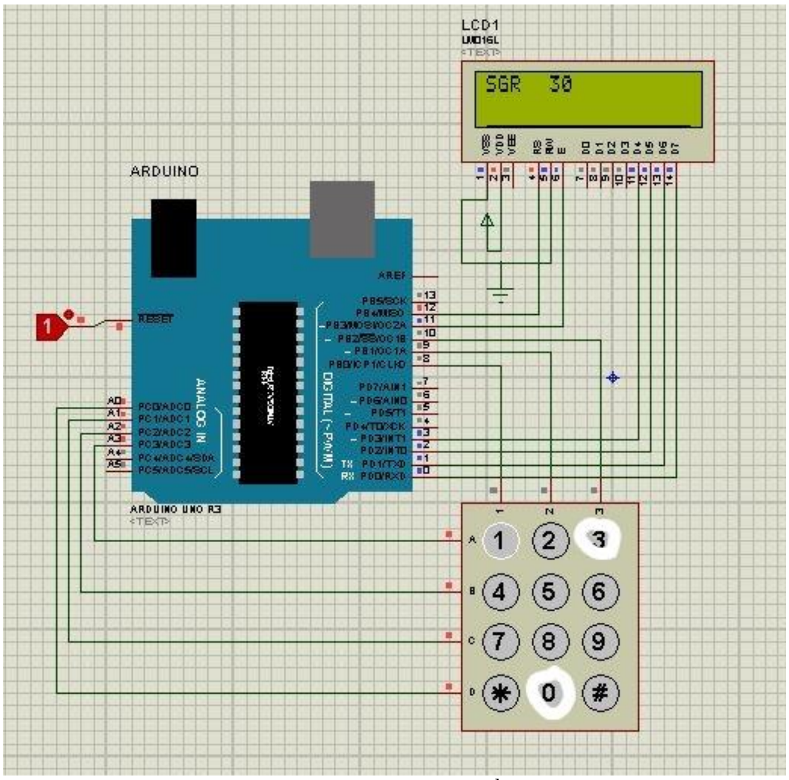

Fig.22 Step 4th

• Furthermore, cross check whether price of the grain is changed or not by just selecting corresponding mode .Later automatically price for grain whose weight contained by system is displayed on the screen.

• Later automatically price for grain whose weight contained by system is displayed on the screen.

• The predefined modes of grains in the system are as follows.

Modes	Grains
0	Sugar
1	Wheat
2	Rice
3	Jowar
4	Bajra (Pearl Millet)
5	Peanuts
6	Soya beans
7	Toor Dal (pigeon pea)
8	oats
9	Dates

Table.4 Grain Selection Modes

6.2 Uniformly Distributed Weight on system (Load cell):

The system, which is described here is weight measurement. The measurement of weight should be accurate and must give stable reading. Accuracy and stability can be achieved by concentrating the weight at the loading point. The arrangement for it can be achieved as shown in figure given below.

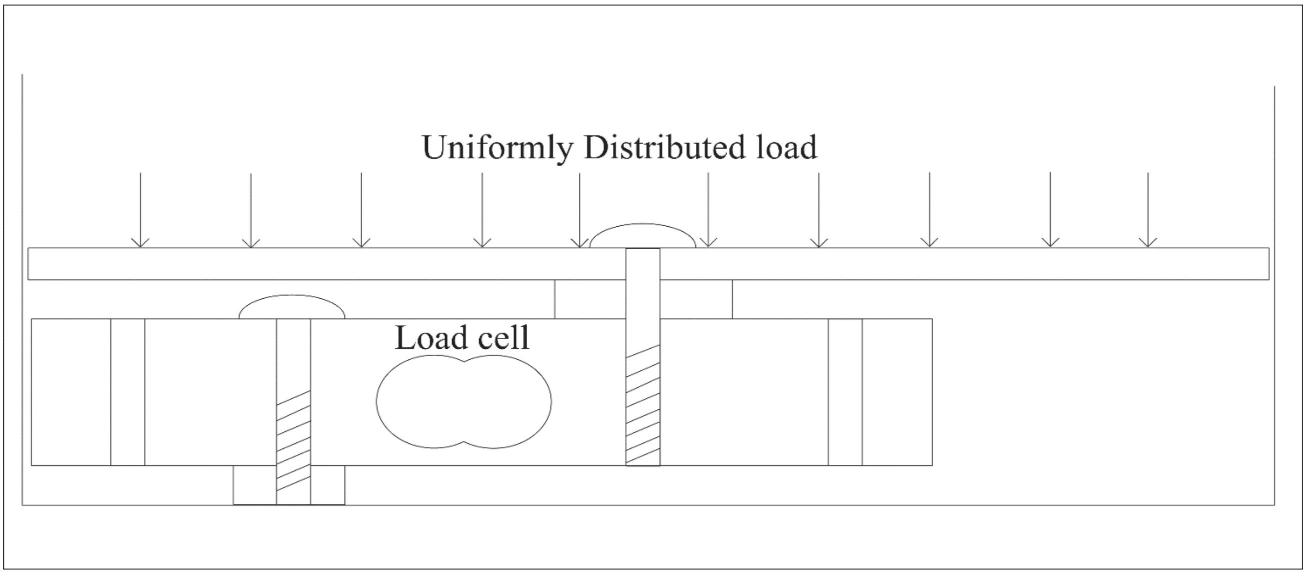

Fig.23 Uniformly Distributed Weight

6.3 Problem facing during weight distribution

Weight of object is accurate when it is normal to the surface of load cell. The problem occurring while weight measurement is that sometimes it shows weight less than actual weight, the concept behind this is based on centre of gravity of vessel. When weight is directly at the centre point on weight panel the reading shows accurate weight, when the vessel get tiled the weight decreases as centre of gravity move from geometrical centre point. The decrease in weight is depend on the cos of the angle of tilt. As the tilt angle increases the weight of the substance in the container decreases. The relation between the weight and angle of tilt is shown in the figure.

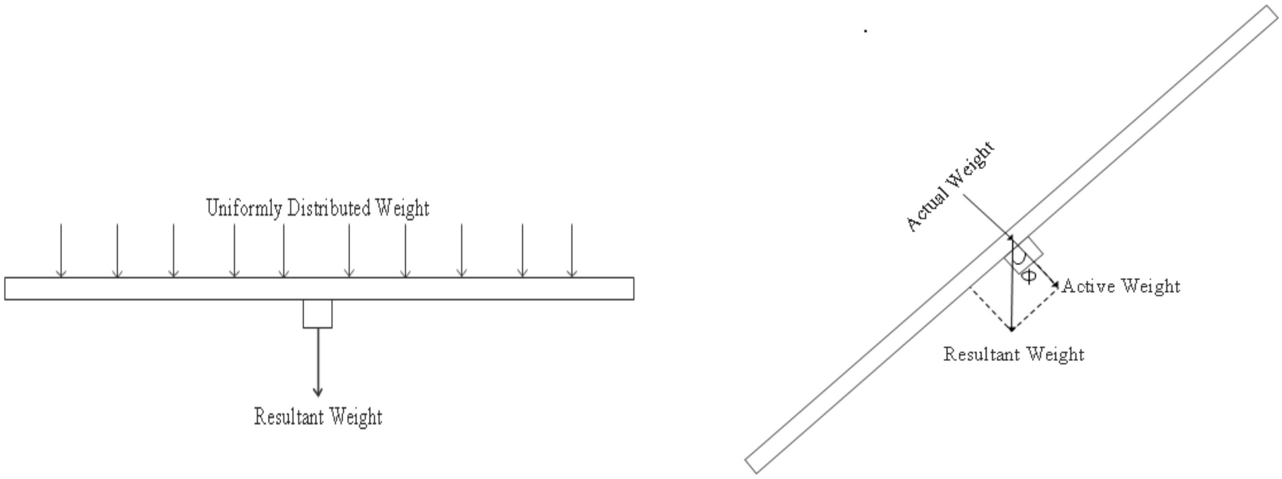

Fig.24 Weight Mechanics

$$w = w\cos(\emptyset)$$

Where

$$0 < \emptyset < 90$$

Hence , The actual weight (w) is greater than weight measure ($w\ cos(\emptyset)$).

$$w > w\ cos(\emptyset).$$

6.4 Solution on the problem

- The above problem is sort out by using Gyro Sensor in the container. The weight showing is displayed only when all mass of the substance under measurement is at centre of the weight panel. This can be achieve by stabilizing the container.
- There is also one another method of getting accurate weight by knowing the angle of the tiled and multiplying is cosine angle to weight getting. This method of getting weight shows the accurate results and the weight obtain is constant along the all directions and angles.

6.4 Programming of Arduino Pro Mini

The difference in the Arduino Pro Mini from the Arduino Uno is the form factor. The Pro Mini about **⅙th** the size of the Arduino Uno. The compact size is great for projects where you may need to fit the Arduino into a tiny enclosure, but it also means that the Pro Mini is not physically compatible with Arduino shields.

Another major variation from the standard Arduino lies in the speed at which the ATmega328 runs. The Pro Mini 3.3V runs at 8MHz, half the speed of an Arduino Uno. The 8MHz is still plenty fast, and the Mini will still be capable of controlling almost any project the Arduino Uno can.

One last missing piece of hardware is the Atmega16U2-based USB-to-Serial converter, and the USB connector that goes with it. All of the USB circuitry had to be eliminated for us to make the Pro Mini as small as possible. The absence of this circuit means an external component, the FTDI Basic Breakout, is required to upload code to the Arduino Pro Mini.

Selection of type of board, Port, Baud rate is required as shown in figure. The Pro Mini's pins surround three of the four sides. The pins on the short side are used for programming, they match up to the FTDI Basic Breakout. The pins on the other two sides are an assortment of power and GPIO pins (just like the standard Arduino).While program is uploading, RESET button of Arduino UNO have to press otherwise code will not upload to Pro Mini. The DTR (Data Write) pin is provided to reset at correct time, which is connected to RESET pin of Arduino UNO. When reset is required DTR gives low signal to RESET pin. Thus in this way Programming is completed.

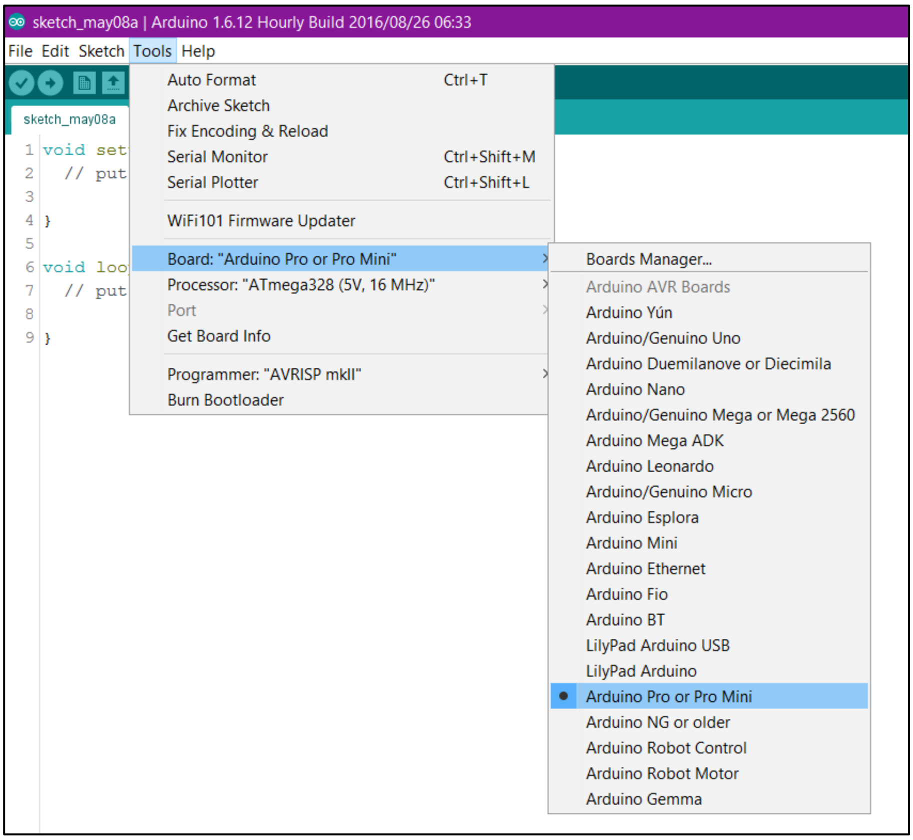

Fig.25 Board Selection

There are three different power-related pins: **GND**, **VCC**, **RAW**, **Rx**, **Tx** and **DTR**, obviously, is the common/ground/0V reference. RAW is the input voltage that runs into the regulator. The voltage at this input can be anywhere from 3.4 to 12V. The voltage at VCC is supplied directly to the Pro Mini, so any voltage applied to that pin should already be regulated to 3.3V. Four pins are actually not located on the edge of the board: A4, A5, A6 and A7. Each of these analog pins is labelled on the back side of the board. A4 and A5's location may be very important if you plan on using I^2C with the Pro Mini – **those are the hardware SDA and SCL pins.**

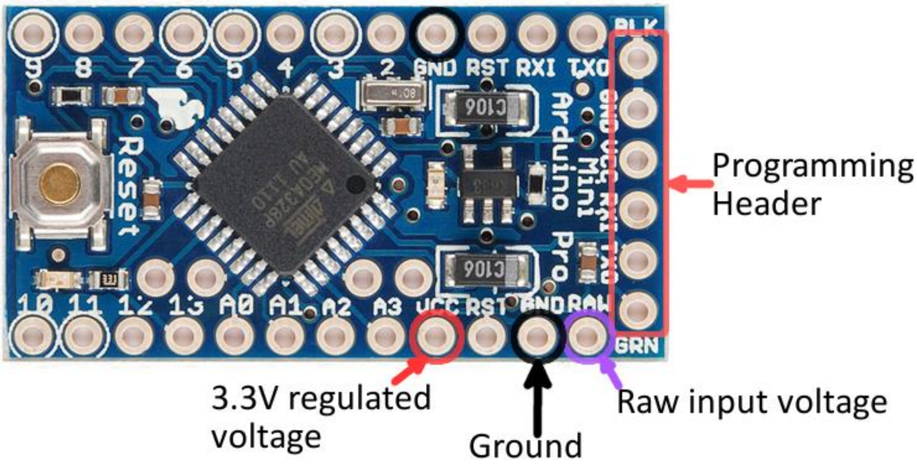

Fig.26 Arduino Por Mini

6.5 Deciding the Capacity of Container

$$volume = (area) * (height)$$
$$= \pi r^2 h \ \text{cm}^3$$
$$\text{Where} \quad r = 7\ cm$$
$$h = 12\ cm$$
$$Volume = 3700\ \text{cm}^3$$

Considering,

density of Sugar =1550 kg/m^3

total capacity of the container =(volume)*(density)

= 3700*10^{-6} *1550

= 5.73 Kg

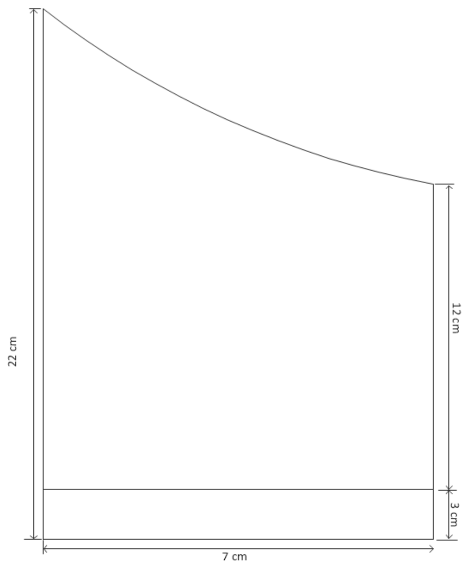

Fig.27 Structure of Container

CHAPTER 7

7.1 HARDWARE REQUIREMENTS:

Table 3: Components Rating

NAME	SPECIFICATION	QUNTITY
Arduino Nano	**32 Pin DIP IC**	1
Load cell	**3kg**	1
Load cell Amplifier(HX711)	**-**	1
ADC	**24Bit**	1
Keypad	**4*3 Numeric**	1
LCD Display	**16*2 size**	1
Battery	**9v**	1

7.2 SOFTWARE REQUIREMENTS:

1. INTEGRATED DESIGN ENVIRONMENT (Arduino)
2. MATLAB (SIMULINK)
3. PROTEUS

7.3 ADVANTAGES:

1. Required less time.
2. Low cost (People can purchase it for household use).
3. Minimum maintenance.
4. Light in weight.
5. Compact in size.
6. Reduce the human effort and time.
7. Low power electronic and mechanical parts.
8. It is portable in use.
9. Specially for women, for making delicious food best proportion of goods is required, so it will helpful in kitchen rooms.

7.4 DISADVANTAGES:

1. It can measure weight of specific items.
2. Its range is limited to measure weight upto 5kg in single time.

7.5 Future scope:

The instrument that we are building is for measurement of weight, along with it if we built instrument for measurement of liquid quantity then these all will have following future scopes, despite of their various number of benefits.

1. Quality of product.
2. Fat content of milk.
3. Water content of milk.
4. Blending of honey can be identified

Conclusion:

The Handy Weight Measuring Instrument is beneficial in malls since no separate pots are required and directly we can measure weight of product. It’s easy to handle way saves time of shopkeeper and customer too. The quality and quantity measurement gives understanding for the customer to buy pure product.

The paper presents new approach for weight measurement which is compact in size, easy to handle, low cost and user-friendly. The performance of Arduino pro mini is found suitable for weight measurement over a traditional system. This proposed topology eliminates drawbacks of traditional weight measurement system and improves overall system performance.

Future work will be carried out by giving a training to weight measurement device using neural network to improve the overall efficiency and quality.

REFERENCES

1. Jordi Palacín, Member, IEEE, José Antonio Salse, Ignasi Valgañón, and Xavi Clua, IEEE transactions on instrumentation and measurement, vol. 53, no. 5, Spain 2004, pp. 1420-1423.
2. Karthick.T, Ravikumar.A, Selvakumar.L, Viknesh.T, Parthiban.B and Gopinath.A “Autonomous cleaner Robot’ International Journal of Science, Engineering and Technology Research (IJSETR), Volume 4, Issue 5, May 2015.
3. Abhishek Pandey ,Anirudh Kaushik, Amit Kumar Jha,Girish Kapse ‘ Autonomous Home Cleaning Robot’ International Journal of Scientific and Research Publications, Volume 4, Issue 4, April 2014 1 ISSN 2250-3153.
4. Coverage Path Planning for Mobile Cleaning Robots, Marten Wanders, University of Twente, The Netherlands 2011, pp.3-5 .
5. A topological coverage algorithm for mobile robots, Sylvia C. Wong Bruce, A. MacDonald, NZ 2012, pp. 2-5