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MATERIAL WEIGHING CONVEYOR MODEL

Jayesh Sanjay Nikam[1], Prof. H. Ambore[2]
Department of Electronics and Telecommunication Engineering
Shreeyash College of Engineering & Technology, Aurangabad, Maharashtra

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Abstract

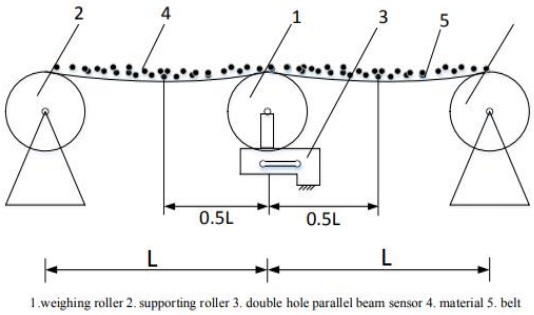
In this project "Material weighing Conveyor", instead of using manual inspection here we are introducing the automatic system by using the loadcell for weight measument. The sensors are used to measure the material presence and this signal is given to control Unit. The control unit gives the appropriate signal to the motor and separator.

In this type of conveyor sensors are used to measure the presence of parts placed over it and a separator is placed next to the sensor which will remove the detective parts. By using this system, we completely eliminate manual work and reduce inspection time and also increase production rate.

Keywords: Arduino Mega: Collecting Box; Conveyor; DC motor; Load Cell; Servo motors

1.Introduction

Electronic belt-conveyor scale is a kind of measuring equipment for weighing material continuously in the process of conveying solid bulk material by belt conveyor. It can measure the instantaneous flow and cumulative flow of material on the belt without interrupting the material flow. It is widely used in industrial production. Figure is the schematic diagram of the weighing principle of a single idler electronic belt-conveyor scale used for conveying



1.weighing roller 2. supporting roller 3. double hole parallel beam sensor 4. material 5. belt

Fig 1: electronic conveyor belt scale demo

pulverized coal in an electric power plant. It consists of weighing roller, supporting roller, double hole parallel beam sensor, material and belt.

The weight of the material is measured by the sensor under the weighing roller. In order to simplify the research model, it is assumed that the material layer on the belt is uniform and the belt moves uniformly. Because the weight measurement of the electronic belt-conveyor scale is carried out by belt, the physical properties of the belt on the weighing process is very obvious. Belt tension is considered to be one of the most influential factors of weighing. The weight of belt and the gravity of the material lead to a certain sag of the belt. It leads to the change of effective weighing interval measured by weighing roller, thus affecting weighing precision. As shown in Figure, the tensioning device of the electronic belt-conveyor scale changes the sag of the belt by adjusting the position of the tensioner wheel. Tensioning device Tensioner wheel Figure. 3D model of electronic belt-conveyor scale. In order to study the relationship between belt tension and weighing accuracy. By changing the position of the tension wheel and the weight of the material, a series of conclusions are

obtained, so as to improve the weighing accuracy of the electronic belt conveyor scale.

2. LITERATURE SURVEY

In [1] this project focuses on moving product weight measurement. The load cell will generate displacement analog output put corresponding to load placed on it.it allowing to convey and measure the weight while product is moving. Arduino will receive these signals and performs the necessary control actions.

In [2] this measurement and its action will depend on matching the actual weight with the standard set weight on the system.

In [3] this project involves implementing load cell, dc motors, IR sensors Atmega328p Microcontroller, Arduino, ADC.

In [4] A conveyor is developed to piked an product and move it from one palace to other place. The system utilizes a microcontroller and IR sensor to detect an product an controlled the motor motion.

In [5] A weight is continuously measure and also with some functionality like model wise weight measurements, price calculation per 100g gram of weight.

In [6] this project involves a weighing conveyor that measure precise weight while carrying goods.

3.COMPONENTS

1. Conveyor Belt

Fig.2: POLYURETHANE BELT

The system comprises of the main line and a subordinate line on which lighter objects are segregated. The conveyor line is driven by one 30 rpm motors of the DC type. The belt is a flat belt conveyor made up of polyurethane.

2. Load cell

Fig.3: 6 KG LOAD CELL

It is a contact type device used to measure the weight of the product which passes on the conveyor line. This device is mounted under the conveyor belt on which the product passes. The range of the load cell is from 0 to 6kg.

3. DC motors:

Fig.4: DC GEAR MOTOR

The DC motors work using direct current instead of alternating current. The motors are used to drive the system i.e., the motor is coupled to the rollers on which the conveyor belt moves.

4. POKA-YOKE

Fig.5: POKA-YOKE

POKA- YOKE as consider to buzzer. POKA-YOKE for indicating either the product weight is going as per the given set weight value, if the weight is not equal to the set weight value then POKA-YOKE remain on and indicating the weight getting false

5. IR sensors

Fig.6: IR SENSOR

These types of radiations are invisible to our eyes, which can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

6. SPRING

Fig.7: SUPPORTING SPRINGS

This is for the bending support for the conveyor self-weight to balance it for proper precise output.

4.PROBLEM STATEMENT

"Count what is countable, measure what is measurable, and make immeasurable, measurable." Galileo Galilei. AD 1600. Weight measurement has a high priority in modern industry manufacturing processes. This is emphasized by the more frequent use of weight measurement equipment in modern industry manufacturing processes. Reasons for this increase are not only for weight measurement but also for the improvement in versatility. It can therefore be used for more effective process control. Weight measurement in the industrial environment is usually done in a conveyor belt system. Thus, the logical choice for further research and improvement would be on such a system. Weight measurement instrumentation is a highly sensitive equipment that must take measurements, small in quantity, accurately and reliable. This instrumentation is usually used in laboratories where the conditions are suitable. However, the modern industrial environment is not suitable for such sensitive instrumentation. This unsuitable environment consists of irregular temperature changes, vibrations, dust and adjacent machinery which can all contribute to invalid and inaccurate reading. In some industries there is a need for a Weight measurement system that is able to accurately measure the weight of individual parts while they are in movement. There is also a need for a system to calculate the friction coefficient of discrete parts. If the friction coefficient is known then the material of the part is known. This can be achieved by using Newton's friction rules and the acceleration of parts on an angled scale. Some industries need a system that can store data regarding the weight, friction coefficient and the number of parts measured.

5. NOISE

As stated in the paragraph, noise is a problem in weight measurement. The greatest problem, however, is vibrations from the conveyor belt motor. These vibrations are picked up by the sensitive load cell which produces a ripple reading in the excess of 2 to 3 gram.

Fig 8 shows the difference between data with the motor on and the data with the motor off. The solid line illustrates a sample with no load and the conveyor motor on. The dotted line illustrates a sample with no load and the motor off. The dotted line, therefore represents all the noise sources excluding the motor noise. The severity of the motor noise is clearly visible if one compares the solid line (vibrations) with the dotted line (no vibrations)

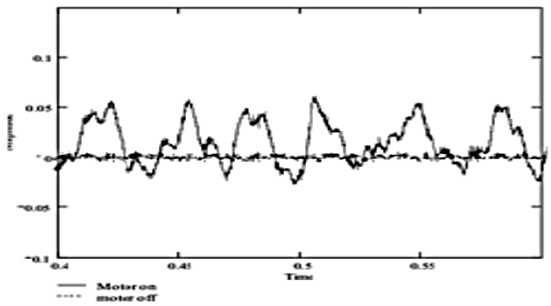


Fig 8. Signal sample with the motor on and the motor off

As seen in **Fig 9**, the noise can be isolated to the band of frequencies between 40 Hz and 200 Hz. Figure 3. Setup for the simulation

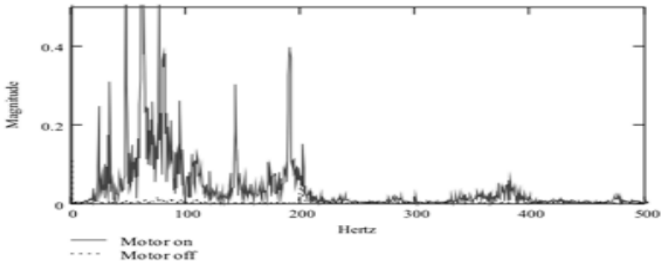


Fig 9. Frequency domain of the noise samples

6.FRICTION COEFFICIENT

Leonardo da Vinci (1452-1519), an Italian artist, engineer and scientist who was primarily famous for his contribution to the arts, was also a pioneer in the sciences. He did intensive research on friction. Unfortunately, these findings were lost for two hundred years before it was discovered by a French physicist Guillaume Amon ton. These findings contributed tremendously to today's laws of friction. The description of friction force is a difficult subject to explain on a microscopic level. It led scientist before Newton in the wrong direction for a long time. A simplified version is that this force is depended on the contact force between the inner workings of the electrons. a. Kinetic friction coefficient Friction forces in which there are some movements are called kinetic friction. One should first consider normal force before friction force is explained further. The normal force is calculated as a trigonometrical cosine function of the angle multiplied by the mass multiplied by gravitational acceleration

Fig 10 is an illustration of this force

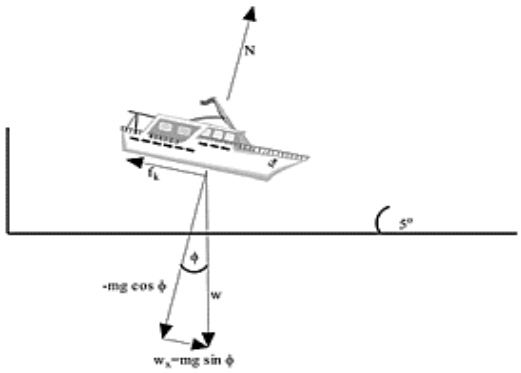


Fig10. The forces on a sliding ship

The imperial law of kinetic friction as stated by Leonardo da Vinci is: The size of the friction force between unlubricated, dry services of which one is sliding over the other is proportional to the normal force. The friction force is uninfluenced by the area of contact or the relative speed.

$$f_k = u_k mg\cos\phi \qquad 5$$

Substituting the normal force, the equation is as follows

$$f_k = u_k N \quad (4)$$

The net to force responsible for acceleration is [8]

$$F_x = w_x - f_k \quad (6)$$

Substituting all the forces will give the following:

$$F_x = mg\sin\phi - u_k mg\cos\phi \quad (7)$$

The acceleration is thus.

$$a_x = \frac{F_x}{m} \quad (8)$$

From Equation can the acceleration be defined as

$$a_x = \frac{mg\sin\phi - u_k mg\cos\phi}{m} \quad (9)$$

$$a_x = (\sin\phi - u_k\cos\phi)g$$

Thus, the Uk or the acceleration is only dependant on the material used. The friction coefficients of some materials are shown in the following Table. Table 1 Kinetic friction Coefficients.

Coefficients of kinetic friction	uk
Steel on steel	0.57
Aluminium on steel	0.47
Copper on steel	0.36
Rubber op concrete	0.8
Ice on ice	0.03
Teflon on Teflon Human joints	0.04 0.003

The angle of the scale is constant as well as the speed at which the parts are fed to the scale. The only changeable component that is responsible for the acceleration is the friction coefficient of the part. Thus, an algorithm can determine the time of the part on the scale. The time on the scale is proportional to the acceleration which in turn is proportional to the material used. The system is now able to determine the material used

7. RESULTS AND DISCUSSION

Our aimed is to developed an material weighing conveyor system model. This system model is basically worked on the principle of change in the displacement and detect the precise weight of the desire set standard weight of the given product.

- Steps follow to set the weight to measure on the conveyor belt:

Step 1: Press the select key the menu option will pop up.

Step 2: choose the MODE option from MENU and the display will pop up the three options as

WIEGHT

PRICE

MODEL SELETION

STEP 3: If WEIGHT mode selected then it will go into weight mode to calculate weight.

STEP 4: If the mode PRICE selected it will pop the window for price putting for per 100gram of the weight. And calculate weight value as per the weight value.

Step 5: to select the MODEL wise selection you will press on the MODEL SELECTION option it will pop three option like

MODEL_1

MODEL_2

MANUAL MODE

Select one out of the above as per selection it will check the current weight with the measure weight value of moving product if it is equal then the product will pass and conveyor running.

There is providing the three sensors

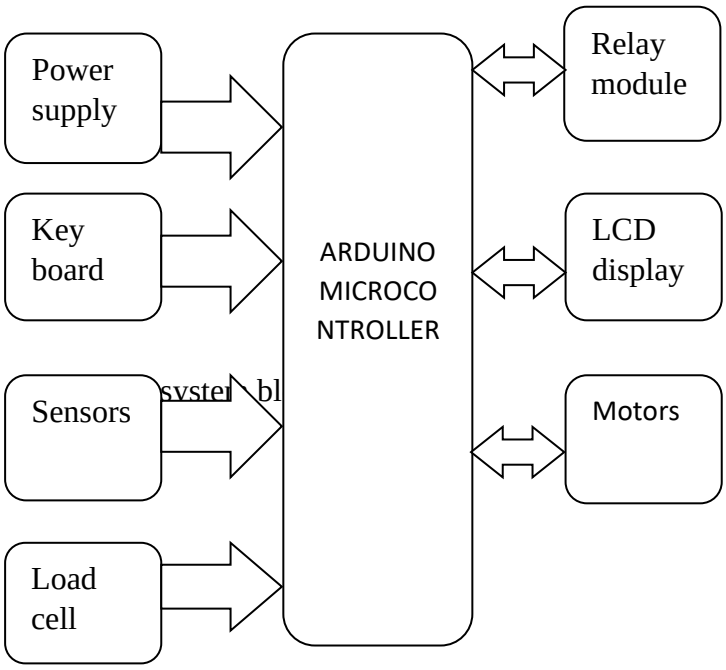
SENSOR_1

SENSOR_2

SENSOR_3

This sensor detects the product and star and stop the conveyor as per the controlling and measuring function of moving object.

Working flow chart and system block diagram Material weighing conveyor model



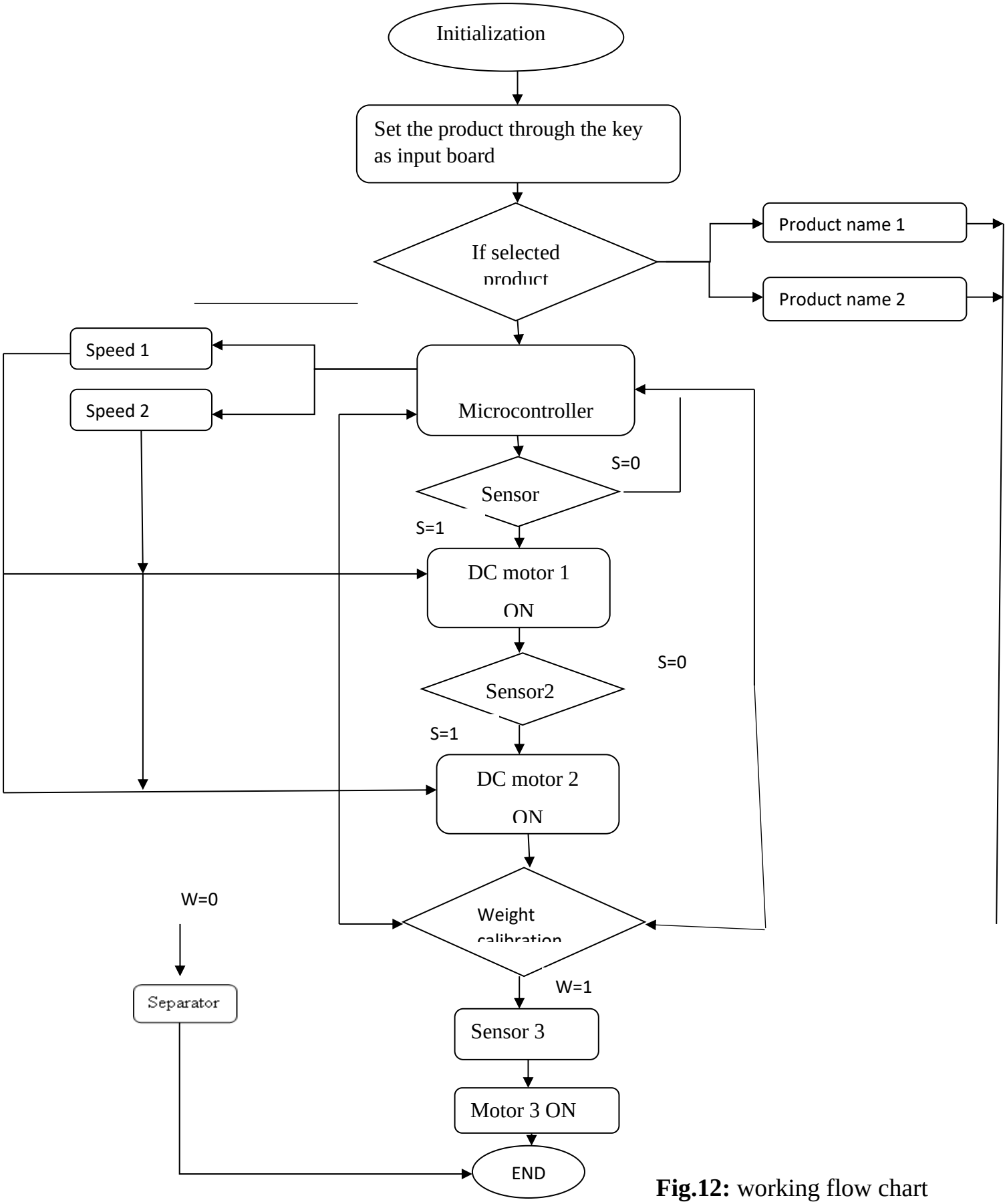


Fig.12: working flow chart

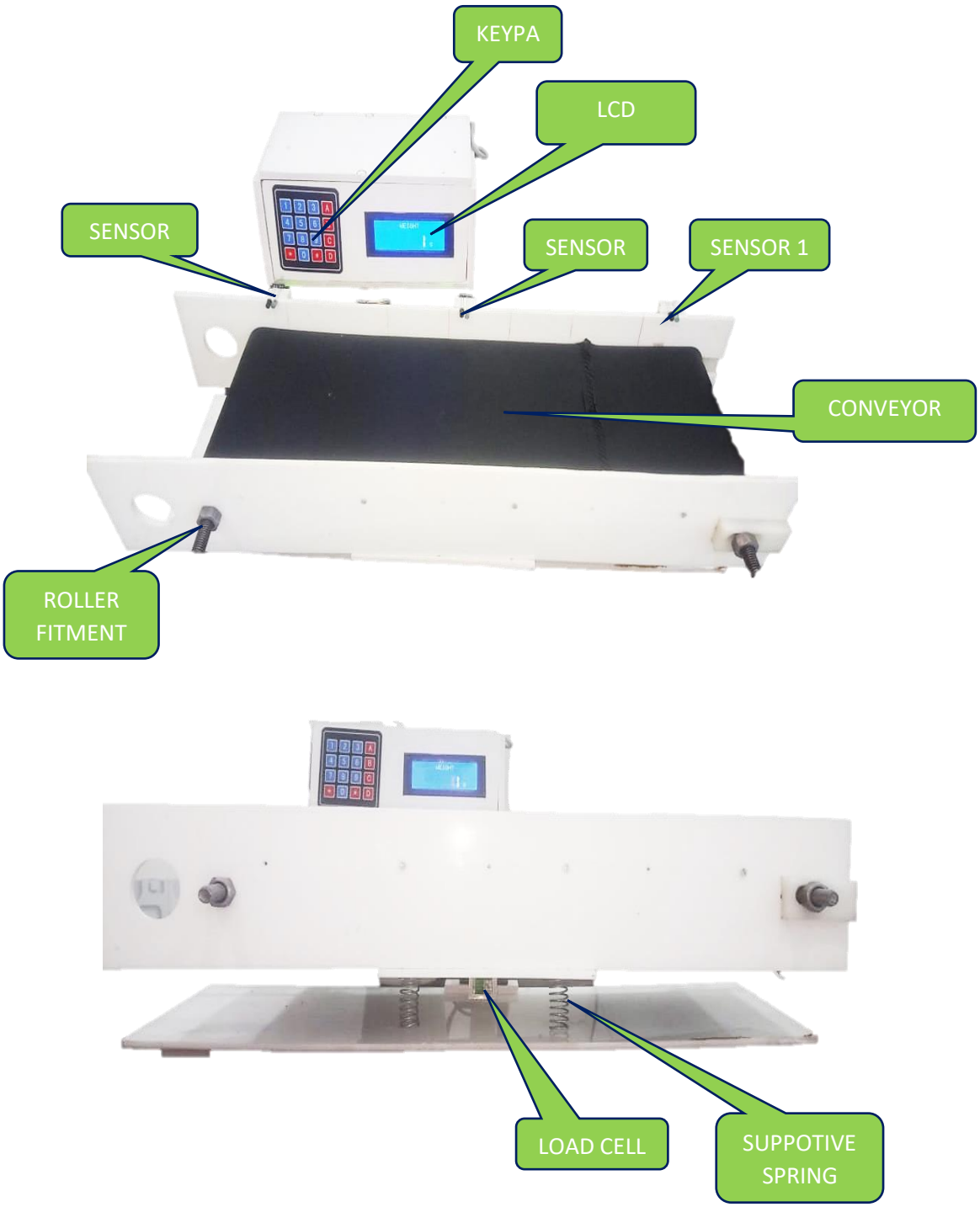
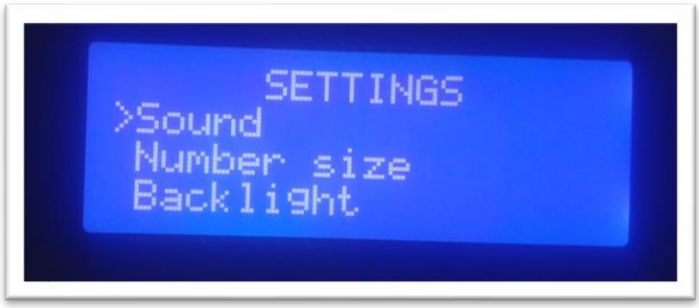


Fig.13: System working model

- ❑ MEASURNG THE WEIGHT CONTINUE THIS IS FOR TO PUT MEASURE VALUE IN MANUAL SLECTION PAGE

- ❑ PRESS SELECT KEY TO POP UP THE MENU WINDOW. WITH OPTION: -
  - ❑ [MODE, UNITS, SETTINGS]

- ❑ AGAIN PRESS SELECT TO POP UP THE MODE WINDOW WITH OPTION: -
  - ❑ [WEIGHT, PRICE, ALERT]



- ❑ PRESS SELECT TO POP UP THE SETTING WINDOW WITH OPTION: -
  - ❑ [SOUND, NUMBER SIZE, BACKLIGHT]

- ❑ PRESS SELECT TO POP UP THE ALERT WINDOW WITH OPTION: -
  - ❑ [MODEL1, MODEL2, MANUAL MODE]

- ❑ PRESS SELECT TO POP UP THE UNITS WINDOW WITH OPTION:-
  - ❑ [GRAM, KILOGRAM]

- ❑ PRESS PRICE THE ABOVE WINDOE POP UP AND PUT THE PRICE PER 100G OF WEIGHT

- ❑ AFTER PRESSING THE MANUAL MODE IN ALERT PAGE OPTION ABOVE WINDOE POP UP. ENTER THE NEEDED WEIGHT IN MANUAL MODE.

- ❑ PRESS TARE TO MINUS THE CURRENT WIEGHT OF CONVYOR.

- ❖ SELECTOR key for MENU and MODE selection.

- ❖ BACK key for get back into previous MENU or MODE.

- ❖ DOWN key for cursor moving downward direction.

- ❖ UP key for cursor moving upward direction.

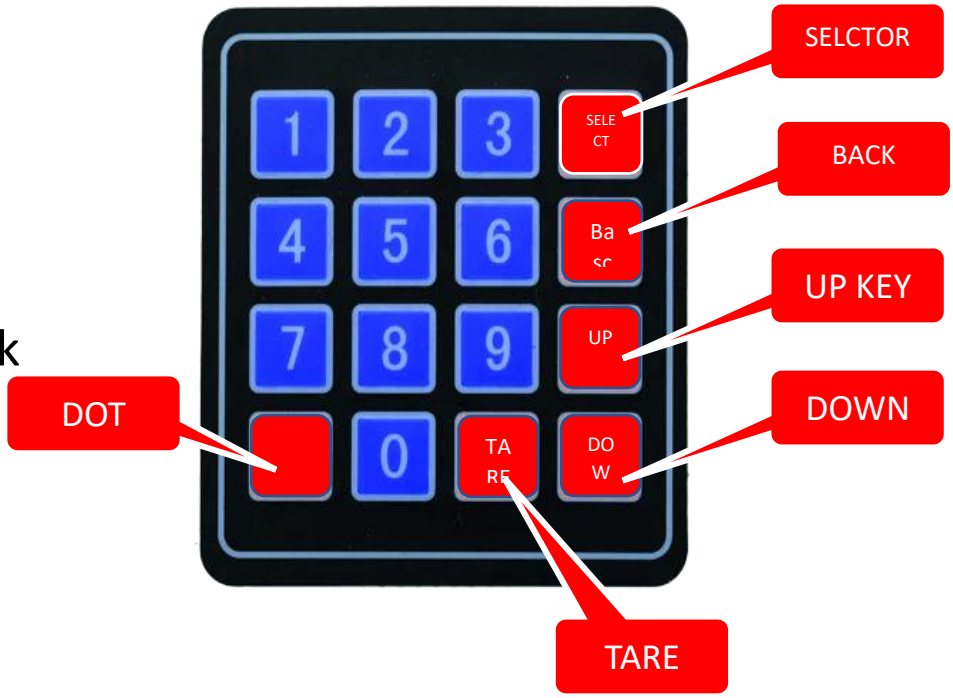


Fig 14: Keypad keys indication

8.Calibration:

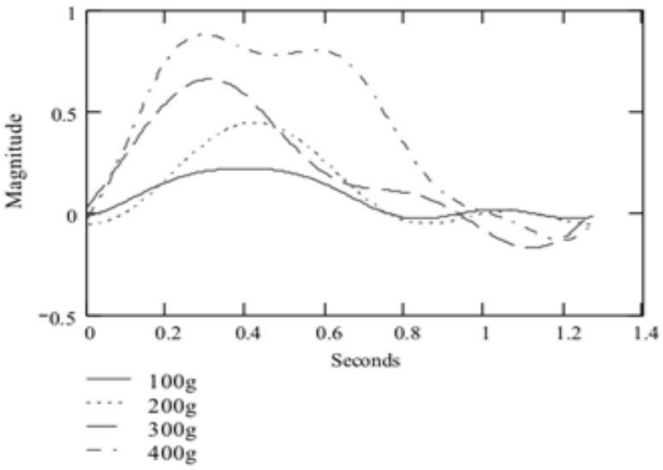


Fig no. 100 gram, 200-gram, 300 gram and 400-gram samples for calibration

9.APPLICATIONS

Robots can be used in numerous industries and hazardous environment, where it is risky for humans to work.

It has application in material handling systems and manufacturing industries like.

Food industry

ii. Agricultural products scaling and grading

iii. Mineral Sorting

iv. Pharmaceutical

v. Handling biomedical waste bags

vi. Airport

CONCLUSION

We have proposed a system which would increase the production rate and accuracy of material handling systems. The system would segregate objects based on their type i.e., required by the user. Use of ARDUINO will make program modification easy and thus, I can modify the system according to the requirement.

FUTURE SCOPE

1. Segregation based on size can be done by installation of sieves of various sizes.
2. pH sensors can be installed for food industry application to check the freshness.
3. Replacing DC motors by stepper motors to increase accuracy.
4. Sensors can be replaced by cameras for digital processing which is done using MATLAB
5. Robotic arm can be used instead of flippers and containers to place the product at desired locations, thus making the process of sorting more effective.
6. Modifications can be done to inspect cracks, defects on the surface of the product etc

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