SAMPLE PROJECT REPORT 2020-2021

FOOD GRAINS CLEANING MACHINE

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MECHANICAL ENGINEERING

Submitted by

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ABSTRACT

Any food grains in the kitchen, they must be cleaned with water thoroughly before cooking, it is a laborious work doing it manually, and hence this machine is designed for the benefit of chefs in hotels and also for the benefit of women's in the domestic kitchens. The same machine also can be used for cleaning the cutlery like plates, spoons, cups, glasses, etc. can be cleaned effectively. In addition this machine can be used in automobile work shops for cleaning the nuts, bolts and other spare parts and hence it can be used for multiple applications. The machine equipped with vertical crank sliding mechanism is motorized. A vertical stand with strong basement is required to hold the mechanism. With the help of a smooth slider attached to the vertical stand, the utensil made with stainless steel mesh that holds food grains will be lowered and raised continuously. When the vertical moving mechanism is attached to the crank slider, and when the motor is energized, the food grains utensil moves up and down with a force. If a bucket of water kept under the utensil, the food grains will be dipped in to the water and lifted continuously, as this process continuous for 2-3 minutes, food grains will be cleaned systematically. After completing the cleaning process, the utensil can be tilted to transfer the grains in to another container.

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INTRODUCTION

CHAPTER-1

INTRODUCTION

Agricultural processing is directed towards conservation of produce and value adding to make the material more readily usable, consumable and economically more remunerative. Harvested grain (threshed / shelled / dried) needs further processing to get rid of various types of contaminations or undesirable matter, viz., inert material, common and grains of noxious weeds, other crop/variety grains, damaged grains and/or off-size grains. Cleaning and grading result in reduced bulk of the material, high value products, safe and longer storage, more out-turn of better quality milled products. Improper cleaning usually result in grain loss.

The origin of grains goes back to the Neolithic Revolution about 10,000 years ago, when prehistoric communities started to make the transition from hunter-gatherer to farmer. Modern varieties of grains have been developed over time through mutation, selective cropping, breeding and research in biotechnology.

Various forms of archaeobotanical evidence, such as carbonized and semi carbonized grains, coprolites and imprints of grains, husks or spikelet’s on potsherds, have been found during excavations of Neolithic sites.

Ancient grains played a role in the spiritual life of several ancient civilizations, from the Aztecs to the Greeks and Egyptians. Quinoa was called the “mother of all grains” and considered sacred by the Inca people.Amaranth was likewise considered sacred by the Aztecs, and was used as part of a religious ceremony, its cultivation being banned by Spanish colonial authorities . Farro grains are mentioned in the Old Testament.

The first reference to ancient grains as a health food was in Daily News (New York) in 1996. Since then the popularity of ancient grains as a food has increased.

Proponents of ancient grains say that they are rich in protein, acids and antioxidant. Some nutritionists state that they are not inherently more healthy than modern grains, and that ancient and modern grains have similar health benefits when eaten as whole grains. This has led to criticism of the grouping as unscientific and driven by marketing.

Some, but not all, ancient grains are gluten-free. Amaranth, quinoa, buckwheat, millet, and teff are gluten-free, but oats and the ancient kinds of wheat (including spelt, einkorn, and Khorasan wheat) are not.

A grain is a small, hard, dry seed - with or without an attached hull or fruit layer harvested for human or animal consumption. A grain crop is a grain producing plant. The two main types of commercial grain crops are cereals and legumes. After being harvested, dry grains are more durable than other staple foods, such as starchy fruits (plantains, breadfruit, etc.) and tubers (sweet potatoes, cassava, and more). This durability has made grains well suited to industrial agriculture, since they can be mechanically harvested, transported by rail or ship, stored for long periods in silos, and milled for flour or pressed for oil. Thus, major global commodity markets exist for maize, rice, soybeans, wheat and other grains but not for tubers, vegetables, or other crops.

Fig 1.1: Cereal grain seeds clockwise from top-left: wheat, spelt, oat, barle

1.1 Classification of grains

1.1.1 Warm-season cereals

1. Finger millet
2. Fonio
3. Foxtail millet

4. Japanese millet
5. Job's tears
6. Kodo millet
7. Maize
8. Millet
9. Pearl millet
10. Proso millet
11. Sorghum

1.1.2 Cool-season cereals

1. Barley
2. Oats
3. Rice
4. Rye
5. Spelt
6. Teff
7. Triticale
8. Wheat
9. Wild Rice


Fig 1.2: Rye Grains

1.1.3 Pseudocereal grains

1. Amaranth
2. Buckwheat
3. Chia

4. Quinoa
5. Kañiwa
6. Kiwicha

Fig 1.3: Buckwheat

1.1.4 Mustard family

1. Black mustard
2. India mustard
3. Rapeseed

1.1.5 Other families

1. Flax Seed
2. Hemp Seed
3. Poppy Seed

CHAPTER-2

LITERATURE SURVEY

CHAPTER-2
LITERATURE SURVEY

We have reviewed following research papers majorly being related with the technology which we have used in our project work "**Food Grains Cleaning Machine"** apart from books and websites.

[1]. Chethana T.V(2014)

Author proposed a work to develop a low cost, pedal powered machine that is designed using readily available parts. Innovation is its simple design using bicycle components, which is easy to operate and without using electricity. Methodology involved here using pedal operated and vibrating mechanism cleaned variety of grain is collected leaving chaffs, lighter impurities and stones present in the grains.

[2]. Wilber Akatuhurira (2020)

Describes Pedal Operated Seed Cleaner (PoS-Cleaner) was developed and its performance evaluated. Appropriate engineering principles and methodologies were used in the sizing and construction of the machine. The cleaner consists of a bicycle-like pedaling system, hopper, a centrifugal fan, and three cleaning sieves which include two inside interlocking sieves, whose meshes can be adjusted to be larger than the size of the unclean seeds by longitudinally translating the second sieve to achieve the appropriate seed size. The PoS-Cleaner presents a more viable cleaning option for smallholder farmers in rural and remote areas with no access to the national grid, therefore producing high quality Seeds.

[3]. Ankush P. Borkar (2016)

Described design and fabrication of gravity separator for soyabin screening**.** The grain separation machine in the rural areas by the traditional use of hand beating/ separation of the grains. This method reduces for time wasting, energy sapping and more labor. The objective of this work is to decrease the time required for dust separation thus it will be supportive for agriculture field.

[4]. Pravin S. Dahimiwal(2017)

Author proposed to sort the food grains of different sizes, and also polish them at a time in three categories i.e. coarse, medium and fine grains. The wastage will be collected in the collector and impurities (if any) will also get removed with the help of fan/Blower. The slider crank mechanism is used for desired.

[5]. Nagesh S (2014)

Author Proposed a work development of grain separator machine to decrease the time required for dust separation thus it will be supportive for agriculture field. In agricultural field the grain separator machine is required for farmers to decrease the labor cost and also the time. And easily accessible in terms of cost and availability at regional level and also the materials used for the machine construction should be light in weight.

[6]. Adegun(2006)

Author Proposed the design of a mechanical device that solves the separatioon problem associated with a guinea corn and rice mixture. The separating machine designed for the purpose utilizes a reciprocating mechanism. A crank is used to convert the rotary motion of a disc to reciprocating movement of a sieve bed. Mild steel was used for fabrication of component parts. The design and fabrication procedures are highlighted in this paper. Experiments were conducted on the dry densities of locally. Different sizes of the rice and guinea corn were investigated.

[7]. I.Mayanja (2020)

Described a pedal operated maize grain cleaner was conceptualized, designed, fabricated using mild steel. It was tested with materials smaller and larger than maize grain. The pedal operated maize cleaner was determined to have a cleaning efficiency of 83%, seed damage of 2%, separation loss of 8% and cleaning rate of 722 kg/hr. This machine design should meet the needs of small or medium scale enterprises especially in rural areas where electricity is unavailable.

[8]. Usman D. Drambi (2019)

Author proposed pedal operated paddy rice winnower for small scale rural farmers was developed to work under the condition of Bauchi state. It was locally fabricated in center for industrial studies (CIS), Abubakar Tafawa Balewa University Bauchi. The whole machine was constructed from steel, angle iron, sheets, bearing, chain and sprockets, shaft, bolts, nuts, and bicycle frame.

CHAPTER-3

EXISTING METHODS

CHAPTER-3
EXISTING METHODS

Based on the past experiences we have few methods of grain cleaning.

1. Pedal operated grain cleaner
2. Pedal operated seed cleaner

3.1 Pedal operated grain cleaner

In the developing world, powered grain cleaners exist, but they are impractical in rural regions because of electricity are expensive or unavailability. The objective is to develop a low cost, pedal powered machine that is designed using readily available parts. Innovation is its simple design using bicycle components, which is easy to operate and without using electricity. Methodology involved here using pedal operated and vibrating mechanism cleaned variety of grain is collected leaving chaffs, lighter impurities and stones present in the grains

Agriculture is the backbone of Indian Economy. Agriculture is basically an energy conversion industry farm is an energy consumer and a producer, because with the use of the different energy inputs, energy output as a crop production is available. Almost all the food, feed, fibre and fuel commodities go through a number of postharvest processing operations such as cleaning, grading, separation, drying, storage, milling, food processing, packaging, transport and marketing before it reaches to the consumers.

Agricultural processing is directed towards conservation of produce and value adding to make the material more readily usable, consumable and economically more remunerative. Harvested grain (threshed / shelled / dried) needs further processing to get rid of various types of contaminations or undesirable matter, viz., inert material, common and grains of noxious weeds, other crop/variety grains, damaged grains and/or off-size grains. Cleaning and grading result in reduced bulk of the material, high value products, safe and longer storage, more out-turn of better quality milled products. Improper cleaning usually result in grain loss.

Cleaning helps to reduce bulkiness during subsequent post harvest operations. To remove straw pieces, unfilled grains and other foreign materials, cleaning and winnowing can be done manually, using wind energy or with the use of machines. Traditional winnowers like the winnowing basket and wooden boxes with perforations are used also motorized grain cleaners using electric power are in use. Cleaning removes unwanted materials like straws, chaff, weed seeds, soil particles and rubbish from the grain. It improves grain storability, reduces dockage during milling, gives good quality milled and improves the milling output. It also reduces insects, pests and disease infestation.

3.1.1 Requirement Definition

This is the most important stage of the design process. This stage includes the clear status of the actual Problem. It is important to know the customer needs and analyze the marketplace to produce a list of requirements necessary to produce a successful product.

1. **Concept development**: In the concept development phase, the needs of the target market are identified, alternative product concepts are generated and evaluated, and one or more concepts are selected for further development and testing.
2. **Concept selection**: Concept selection is the activity in which various product concepts are analyzed and sequentially eliminated to identify the most promising one. Concept selection is the process of evaluating concepts with respect to customer needs and other criteria, comparing the relative strengths and weakness of the concepts and selecting one or more concepts for further investigation, testing or development.
3. **Concept screening and concept scoring:** There are two stages of concept selection, first stage is called Concept Screening and the Second Stage is called Concept Scoring. Each is supported by decision matrixes, which are used to rate, rank and select the best concept. Concept screening, rough initial concepts are evaluated relatives to a common reference concept using the screening matrix. Concept scoring is usedwhen increased resolution will better differentiate among competing concepts.
4. **Detail design**: In this stage of the design process, the chosen concept design is designed in detail with all dimensions and specifications. The designer should also work closely with manufacture to ensure that the product can be made.
5. **Testing and Refinement**: The testing and manufacturing phase involves the construction and evaluation of preproduction versions of the product.

Prototypes are tested to determine whether the product will work as designed and whether the product satisfies the user or key customer needs.

3.1.2 Operation

The force is applied on the main shaft using pedals to drive the sprockets, two different diameter sprockets are connected to each other using chain mechanism that gives rotary motion, the pulley is mounted on the driven sprocket, and thus in-turn is connected to the other pulley. Connecting rod is adjusted to that as the pedaling is done rotary motion is converted into reciprocatory motion thus in turn through eccentric bolts which converts to linear motion thus back and forth action takes place to the tray the sieves on the top of the tray collects the heavier dust particles like stones on the top sieve and lighter impurities based on sieve size mud particles are collected at the second sieve and cleaned variety of grains are collected on the other side.

Fig 3.1: Pedal operated grain cleaner

3.2 Pedal operated seed cleaner

Grains constitute the greatest portion of daily diets for many populations worldwide. They are a major source of carbohydrates, but also provide proteins, fiber, as well as micronutrients such as vitamins and minerals. Uganda produces both cereal and legume grains. By acreage, the latest agricultural census conducted in 2008/2009 revealed that cereals cover the largest area of cultivated land in Uganda with over 1.7 million ha while pulses cover close to 980 thousand ha of land. However, post-harvest losses continue to be a major challenge in Uganda. According to FAO, WFP and IFAD, critical losses at the household level, an average of 67 kg of beans and 590 kg for maize are lost per year leading to an annual financial loss. The Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF) also partially attributes food insecurity in Uganda to poor post-harvesting handling. Postharvest losses due to quality losses remains one of the most neglected paths through which grains are lost. The ultimate quality of the finished product, storage stability safety from health hazards, and consumer acceptance depends on the cleaning process. Cleaning is one of the important post-harvest steps that aids storage, processing, quality control, and pest management. However, grain cleaning is mainly done using rudimentary manual methods. For instance, majority farmers in Uganda have continued to use their conventional cleaning techniques such as winnowing trays and screens for cleaning maize even with huge maize yields. Not only do these methods contribute to poor post-harvest handling, but they are also tedious, labor intensive, time-consuming. Manual cleaning methods are also characterized by low capacity, high inconsistencies, and low cleaning efficiency since they depend on human perception. Therefore, cleaning operations could best be improved with the use of mechanical cleaning equipment. However, the available imported cleaners are energy demanding, complex to repair, and expensive in terms of ownership, operation, and maintenance. Also, the locally-manufactured grain cleaners, though relatively cheap, are often designed for cleaning a single type of seeds. For instance, the Pedal Operated Maize cleaner (PoM-Cleaner) which was developed in 2018 had an efficiency of 83.1% with Longe 1 H maize variety . This, therefore, excludes other maize varieties as well as other grains that need to be cleaned before selling them. Therefore, there is a need for a single-multipurpose grain cleaning system to alleviate the bottlenecks for grain cleaning among smallholder farmers.

3.2.1 Machine description

The PoS-Cleaner is an adapted and upgraded design of the pedal-operated maize grain cleaner developed to clean not only maize but also all other seeds of size diameter 6.6–18 mm. The PoS-Cleaner is tailored to significantly remove foreign materials such as chaff, stones, dust, and other crops from the desired seeds. The cleaner consists of a bicycle-like pedaling system, hopper, a centrifugal fan, and three cleaning sieves. The three sieves consist of the outer fixed sieve and the two inside interlocking sieves that can be adjusted depending on the size of grains to be cleaned.

During operation, the unclean seeds are fed into the hopper which then flows down gravitationally. At this stage, light foreign materials are blown off by the centrifugal fan. This first separation stage utilizes the difference in aerodynamic property of the materials being separated. After, the seeds are channeled to the rotary sieves for further separation. The fan and sieve rotary motion derived from pedaling supports seed continuous movement through the sieves due to gravity and centrifugal forces. Clean seeds are then collected in one receptacle through the seed outlet.

Fig 3.2: Assembly of the Pedal Operated Seed Cleaner

3.3 Design of the pedal-operated seed cleaner components

3.3.1 HOPPER

The hopper shape is of a square-base pyramid frustum. The volume of the hopper was determined using Eq. (1) Hopper capacity for the different grains was determined using Eq. (2)

$V=h/3(A1+A2+\sqrt{(A1\times A2)})$………….(1)

$M==\rho\times V$…………..(2)

where V is the volume of a hopper (m^3), h is the height of the hopper (m), A1 is the area of the top part of a hopper (m^2), A2 is the area of the bottom part of the hopper (m^2) and ρ is the density of the grain.

3.3.2Trommels (Rotating sieves)

The three sieves that rotate in tandem whereby two inner sieves are meshed together and can be adjusted longitudinally to vary the mesh hole size. This flexibility of adjusting the mesh hole sizes allows grains of varying sizes to be cleaned. To ensure higher cleaning efficiency from the trommels (rotary sieves) length, diameter, speed, and angle of inclination were the major parameters considered . The desired operating speed of trommels was computed relative to the critical speed, the speed at which a centripetal acceleration of 9.8 m/s2 at the screen surface is achieved . According to Mayanja, Kigozi, Kawongolo and Brumm , the best operating speed of the rotating sieve ranges from 33 to 45% of the critical speed. Critical speed (Nc) was determined from the sieve radius using the relationship in Eq. (3)

$Nc=(30/\pi)\sqrt{g/R\sin\theta}$…………(3)

Where Nc is the critical angular speed of the sieve (rpm); R is the radius of the sieve (m); g is the acceleration due to gravity (m/s2); θ is the maximum angle of lifting approximated to be the angle of friction (degrees).

Fig 3.3: Sieves rotating in tandem

3.3.3 Belt and pulley design

The Pedal Operated Seed Cleaner has two pulleys with a belt connection to transmit power from the chain drive to the trommels .The diameter of the pulley is given by the relationship in Eq. (4) while the length of the belt (L) depends on the diameter of the driven and driving pulleys and the center distance between the pulleys given by the relationship in Eq. (5). Center distance (C) between two adjacent pulleys (m) was determined by Eq. (6) . Tension in the tight side of the belt (T1T1) is created on that section of the belt approaching the driver pulley. Tight side tension is a function of both maximum tension and centrifugal tension. Tight side tension is given by Eq. (7). Slack side tension is created on the section of the belt approaching the driven pulley. The slack side tension (T_2) of the belt is given by Eq. (8). The power required in transmitting the belt (P_1) was determined using Eq. (9). Equations to determine the other parameters defined in here can always be found in Khurmi and Gupta

d1/d2=N2/N1……….(4)

L= 2C+1.57(d1+d2)+(d2−d1)2/4C………(5)

C= (d1+d2)/2+d1……(6)

T1= Tmax−Tc……(7)

2.3log(T1/T2)=μØcscβ……….(8)

P1=(T1−T2)V……….(9)

Where d1 is the diameter of the driver pulley (m), d2 is the diameter of the driven pulley (m), N1 is the speed of the driver pulley (rpm), N2 is the speed of the driven pulley (rpm) and C is the center distance between two adjacent pulleys (m) Tmax is the maximum allowable tension in the belt (N), Tc is the centrifugal tension in the belt, β is the half groove angle (degrees), Ø is the angle of lap on the smaller pulley (radians), μ is the angle of friction between the belt and the pulley (unitless),v is the speed of the belt (m/s).

3.3.4 Design of sprockets and chain drives

The driver and driven sprockets are connected through a chain . The driven sprocket (small) runs at the same speed as the driver pulley in the belt-pulley arrangement. The driver sprocket (Big) runs at a speed determined by the relationship given by Eq. (10). The length of the chain (Lc) was determined using Eq. (11).The power transmitted by the chain (P2) based on breaking load was determined using Eq. (12). Equations to determine the other parameters defined in here can always be found in Khurmi and Gupta

NsTs=NbTb………..(10)

Lc=Kp………………...(11)

P2=(Wb×v)/(cn×ks)….(12)

where N_s is the speed of rotation for the small sprocket (rpm), N_b is the speed of rotation for the big pulley (rpm), T_s is the number of teeth for the small sprocket, T_b is the number of teeth for the big sprocket, K is the number of chain links, p is the pitch of the chain, C_c is the center distance between the sprockets (mm), W_b is the breaking load (N), n is the factor of safety, v_c is the velocity of the chain, and k_s is the service factor.

3.3.5 Design of centrifugal blower

A blower is used to move the air constantly with a slight increase in static pressure to allow for separation of the grain-chaff mixture. The blower air discharge was estimated using the expression of continuity as given by Eq. (13).

Q=A4V…………….(13)

where Q is the air discharge (m^3/s), A_4 is the area of the blade (m^2) and V is the velocity of air (m/s) produced form the blower.

3.3.6 Power required to operate the machine

The total power required to run the machine was calculated by summing the power required in transmitting the belt and the chain given by Eq. (14).

P=P1+P2…………(14)

CHAPTER-4

PROPOSED SYSTEM

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Any food grains in the kitchen, they must be cleaned with water thoroughly before cooking, it is a laborious work doing it manually, and hence this machine is designed for the benefit of chefs in hotels and also for the benefit of women's in the domestic kitchens. The same machine also can be used for cleaning the cutlery like plates, spoons, cups, glasses, etc. can be cleaned effectively. In addition this machine can be used in automobile workshops for cleaning the nuts, bolts and other spare parts and hence it can be used for multiple applications

4.1 PROPOSED SYSTEM CONSISTS OF MECHANISM

1. Vertical crank sliding mechanism

4.1.1 Vertical crank sliding mechanism

A vertical slider-crank linkage is a four-link mechanism with three revolute joints and one prismatic, or sliding, joint. The rotation of the crank drives the linear movement the slider, or the expansion of gases against a sliding piston in a cylinder can drive the rotation of the crank.

There are two types of slider-cranks:

1. In-line
2. Offset.

4.1.2 In-line

An in-line slider-crank has its slider positioned so the line of travel of the hinged joint of the slider passes through the base joint of the crank. This creates a symmetric slider movement back and forth as the crank rotates.

4.1.3 Offset

If the line of travel of the hinged joint of the slider does not pass through the base pivot of the crank, the slider movement is not symmetric. It moves faster in one direction than the other. This is called a quick-return mechanism.

4.1.4 Kinematics of the in-line slider-crank:

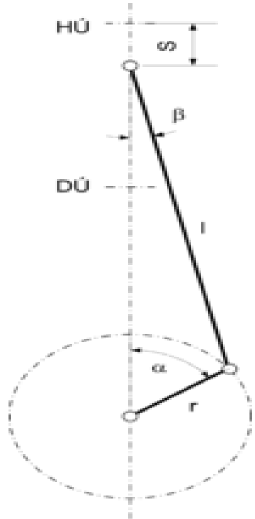

Fig 4.1: Kinematics of in line slider crank

The displacement of the end of the connecting rod is approximately proportional to the cosine of the angle of rotation of the crank, when it is measured from top dead center (TDC). So the reciprocating motion created by a steadily rotating crank and connecting rod is approximately simple harmonic motion:

$$x = r\cos\alpha + l$$

where x is the distance of the end of the connecting rod from the crank axle, l is the length of the connecting rod, r is the length of the crank, and α is the angle of the crank measured from top dead center (TDC). Technically, the reciprocating motion of the connecting rod departs from sinusoidal motion due to the changing angle of the connecting rod during the cycle, the correct motion, given by the Piston motion equations is:

$$x = r\cos\alpha + \sqrt{l^2 - r^2\sin^2\alpha}$$

As long as the connecting rod is much longer than the crank $\boldsymbol{l} >> \boldsymbol{r}$ the difference is negligible. This difference becomes significant in high-speed engines, which may need balance shafts to reduce the vibration due to this "secondary imbalance".

$$\tau = Fr\sin(\alpha+\beta)$$

The mechanical advantage of a crank, the ratio between the force on the connecting rod and the torque on the shaft, varies throughout the crank's cycle. The relationship between the two is approximately:

where τ is the torque and F is the force on the connecting rod. But in reality, the

$$x' = \left(-r\sin\alpha - \frac{r^2\sin\alpha\cos\alpha}{\sqrt{l^2 - r^2\sin^2\alpha}}\right)\frac{d\alpha}{dt}$$

torque is maximum at crank angle of less than α = 90° from TDC for a given force on the piston. One way to calculate this angle is to find out when the Connecting rod small end (piston) speed becomes the fastest in downward direction given a steady crank rotational velocity.

4.1.5 Kinematics of offset slider crank

The position of an offset slider-crank is derived by a similar formula to that for the inline form; using the same letters as in the previous diagram and an offset of o

$$x = r\cos\alpha + \sqrt{l^2 - (r\sin(\alpha) - o)^2}$$

Its speed (the first derivative of its position) is represent able as

$$\frac{-r\cos(\alpha)(r\sin(\alpha)+o)}{\sqrt{l^2 - (r\sin(\alpha)+o)^2}} - r\sin(\alpha)$$

Its acceleration (the second derivative of its position) is represent able as the complicated equation of:

$$\frac{r\sin(\alpha)\,(r\sin(\alpha)+o) - r^2\cos^2(\alpha)}{\sqrt{l^2 - (r\sin(\alpha)+o)^2}} - \frac{r^2\cos^2(\alpha)(r\sin(\alpha)+o)^2}{\left(l^2 - (r\sin(\alpha)+o)^2\right)^{\frac{3}{2}}} - r\cos(\alpha)$$

4.2 BLOCK DIAGRAM

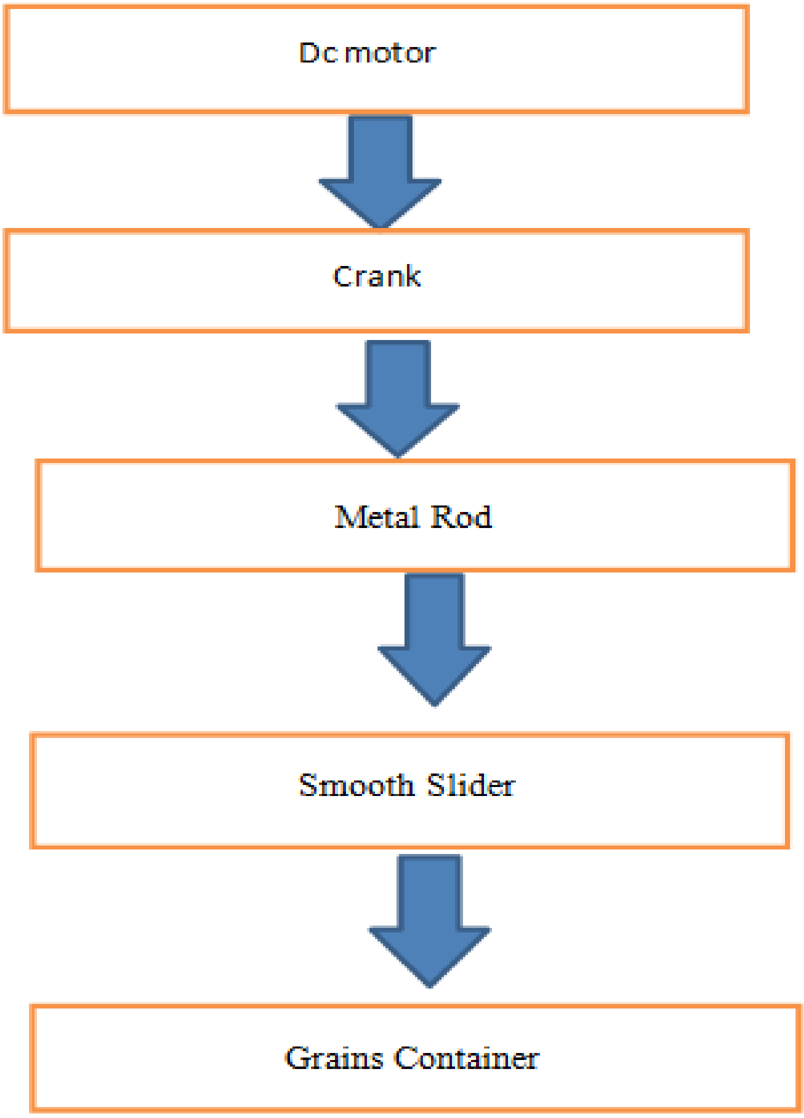

Fig 4.2: Block Diagram of process of food grains cleaning machine

4.3 MECHANICAL DESIGN

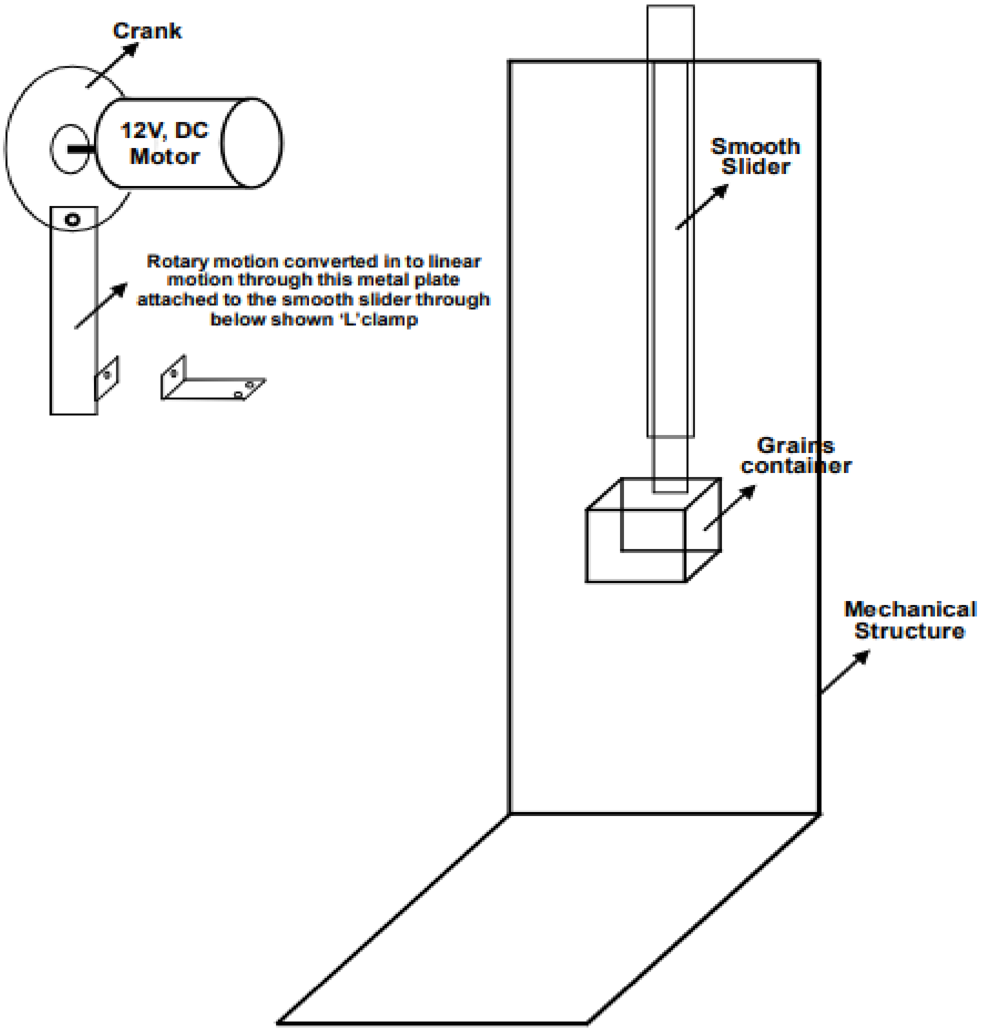

Fig 4.3: Mechanical Design

4.4 Switching transistor

As one of the significant semiconductor devices, transistor has found use in enormous electronic applications such as embedded systems, digital circuits and control systems. In both digital and analog domains transistors are extensively used for different application usage like amplification, logic operations, switching and so on.

Here this description mainly concentrates and gives a brief explanation of transistor application as a switch.The Bipolar Junction Transistor or simply BJT is a three layers, three terminal and two junction semiconductor device. Almost in many of the applications these transistors are used for two basic functions such as switching and amplification. The name bipolar indicates that two types of charge carriers are involved in the working of a BJT. These two charge carriers are holes and electrons where holes are positive charge carriers and electrons are negative charge carriers.

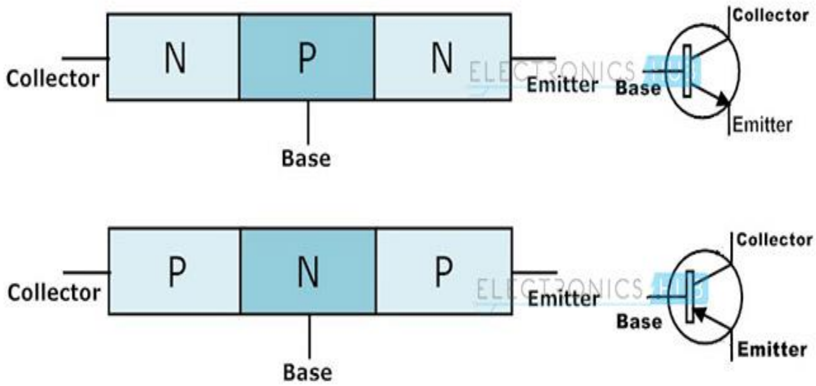

Fig 4.4: Switching Transistor

The transistor has three regions, namely base, emitter and collector. The emitter is a heavily doped terminal and emits electrons into the base. Base terminal is lightly doped and passes the emitter-injected electrons on to the collector. The collector terminal is intermediately doped and collects electrons from base. This collector is large as compared with other two regions so it dissipates more heat.

BJTs are of two types NPN and PNP, both functioning is same but differ in terms of biasing and power supply polarity. In PNP transistor, between two P- type materials N- type material is sandwiched whereas in case of NPN transistor P- type material sandwiched between two N- type materials. These two transistors can be configured into different types like common emitter, common collector and common base configurations.

4.4.1 Operating Modes of Transistors

Depends on the biasing conditions like forward or reverse, transistors have three major modes of operation namely cutoff, active and saturation regions.

Active Mode

In this mode transistor is generally used as a current amplifier. In active mode, two junctions are differently biased that means emitter-base junction is forward biased whereas collector-base junction is reverse biased. In this mode current flow between emitter and collector and amount of current flow is proportional to the base current.

Cutoff Mode

In this mode, both collector base junction and emitter base junction are reverse biased.

This in turn not allows the current to flow from collector to emitter when the base-emitter voltage is low. In this mode device is completely switched off as the result the current flowing through the device is zero. The following is the diagram shows how the transistor functions as switch.

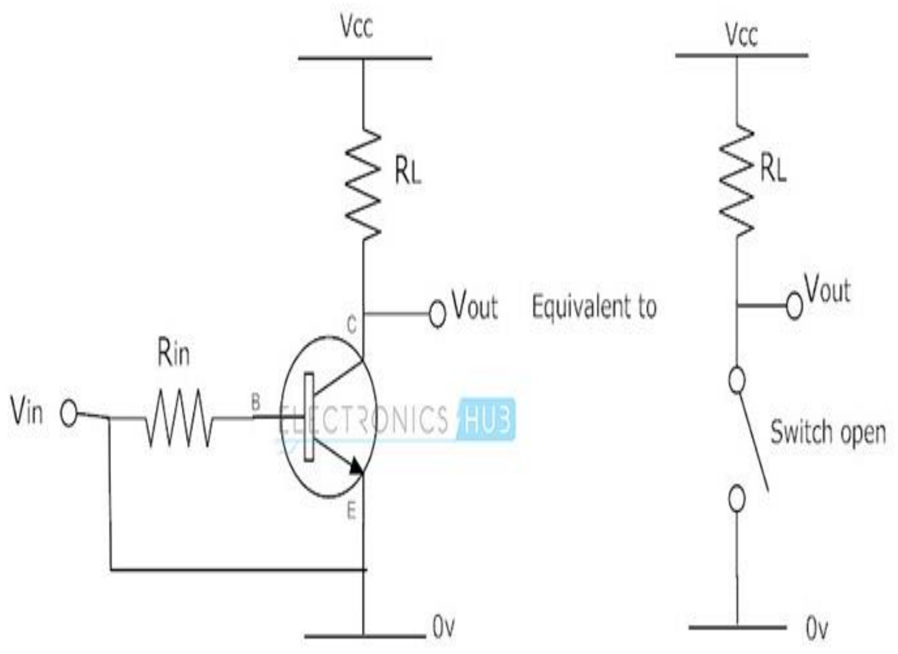

Fig 4.5: Cutoff Mode

Saturation Mode

In this mode of operation, both the emitter base and collector base junctions are forward biased. Current flows freely from collector to emitter when the base-emitter voltage is high. In this mode device is fully switched ON.

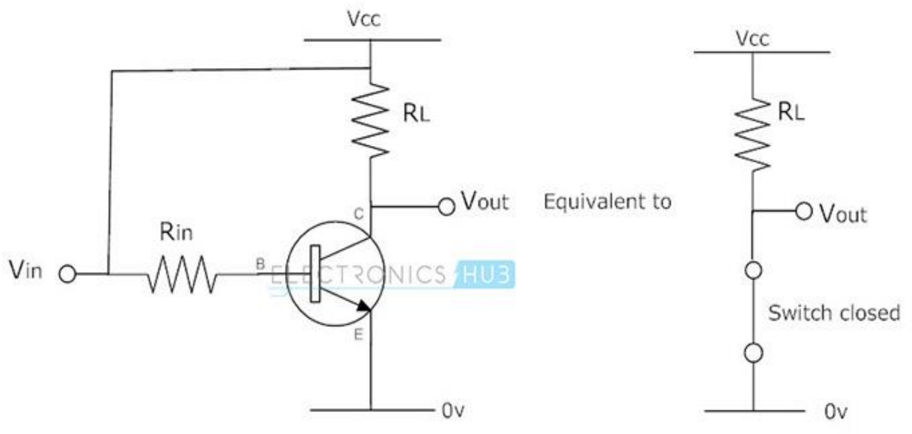

Fig 4.6: Saturation Mode

4.4.2 Transistor as a switch

A transistor is used for switching operation for opening or closing of a circuit. This type solid state switching offers significant reliability and lower cost as compared with conventional relays. Both NPN and PNP transistors can be used as switches. Some of the applications use a power transistor as switching device, at that time it may necessary to use another signal level transistor to drive the high power transistor.

4.4.3 NPN Transistor as a Switch

Based on the voltage applied at the base terminal of a transistor switching operation is performed. When a sufficient voltage (V_{in} > 0.7 V) is applied between the base and emitter, collector to emitter voltage is approximately equal to 0. Therefore, the transistor acts as a short circuit. Similarly, when no voltage or zero voltage is applied at the input, transistor operates in cutoff region and acts as an open circuit. In this type of switching connection, load is connected to the switching output with a reference point. Thus, when the transistor is switched ON, current will flow from son nurce to ground through the load.

4.4.4 Relay

A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Relays are found hidden in all sorts of devices. In fact, some of the first computers ever built used relays to implement gate logics.

4.5 COMPONENTSANDITSFUNCTIONS

Table 4.1: Components and its functions

S.NO	Components	Functions
1	DC Motor	A crank is an arm attached at a right angle to a rotating shaft by which circular motion is imparted to or received from the shaft
2	Crank	A crank is an arm attached at a right angle to a rotating shaft by which circular motion is imparted to or received from the shaft
3	Metal rod	Rotary motion converted into linear motion
4	Key	A simple switch mechanism for controlling some aspect of a machine
5	Smooth Slider	A slide is generally the term that is given to a product that is fixed to the side of the drawer
6	Grains Container	An object of holding the grains
7	Time delay circuit	A circuit in which the output signal is delayed by a specified time interval with respect to the input signal.
8	Control Circuit	A control circuit is a special type of circuit used to control the operation of a completely separate power circuit.

4.5.1 DC Motor

DC motors are widely used, inexpensive, small and poweful for their size. They are most easy to control. One DC motor requires only two singals for its operation. DC motors take direct current voltages as input and convert it into rotation movement. DC motors usually have two wires and can be powered directly from battery or DC power supply. DC motor can also be powered through drivers circuit that can regulate the speed and direction of the motor. For robot application, DC motor are typically used because of low cost, variable speed, required high starting torque than running torque, and frequent start/stop cycles or closed-loop positioning required. The usual voltage of DC motors used in robotics is 6V and 12V motor. The gear shaft contains inside the power window motor will definitely increase the torque of the motor.

They are non-polarized, means you can reverse the voltage without any damage to motor. DC motors have +ve and –ve leads. Connecting them to a DC voltage source moves motor in one direction (clockwise) and by reversing the polarity, the DC motor will move in opposite direction (counter clockwise). The maximum speed of DC motor is specified in rpm (rotation per minute). It has two rpms: no load and loaded. The rpm is reduces when moving a load or decreases when load increases. Other specifications of DC motors are voltage and current ratings. Below table shows the specifications of the motor used in the project.

Fig 4.7: Electromagnetism

Table 4.2: DC Motor Specifications

Operating Voltage	12V DC
Operating Current	150MAmps
Speed	30 RPM

OPERATION

Most electric motors work by electromagnetism, but motors based on other electromechanical phenomena, such as electrostatic forces and the piezoelectric effect, also exist. The fundamental principle upon which electromagnetic motors are based is that there is a mechanical force on any wire when it is conducting electricity while contained within a magnetic field. The force is described by the Lorentz force law and is perpendicular to both the wire and the magnetic field. Most magnetic motors are rotary, but linear types also exist. In a rotary motor, the rotating part (usually on the inside) is called the rotor, and the stationary part is called the stator

One of the first electromagnetic rotary motors was invented by Michael Faraday in 1821 and consisted of a free-hanging wire dipping into a pool of mercury. A permanent magnet was placed in the middle of the pool of mercury. When a current was passed through the wire, the wire rotated around the magnet, showing that the current gave rise to a circular magnetic field around the wire. This motor is often demonstrated in school physics classes, but brine (salt water) is sometimes used in place of the toxic mercury. This is the simplest form of a class of electric motors called homopolar motors. A later refinement is the Barlow's Wheel.

Another early electric motor design used a reciprocating plunger inside a switched solenoid; conceptually it could be viewed as an electromagnetic version of a two stroke internal combustion engine.The modern DC motor was invented by accident in 1873, when Zénobe Gramme connected a spinning dynamo to a second similar unit, driving it as a motor.

The classic DC motor has a rotating armature in the form of an electromagnet. A rotary switch called a commutator reverses the direction of the electric current twice every cycle, to flow through the armature so that the poles of the electromagnet push and pull against the permanent magnets on the outside of the motor. As the poles of the armature electromagnet pass the poles of the permanent magnets, the commutator reverses the polarity of the armature electromagnet. During that instant of switching polarity, inertia keeps the classical motor going in the proper direction. (See the diagrams below.)

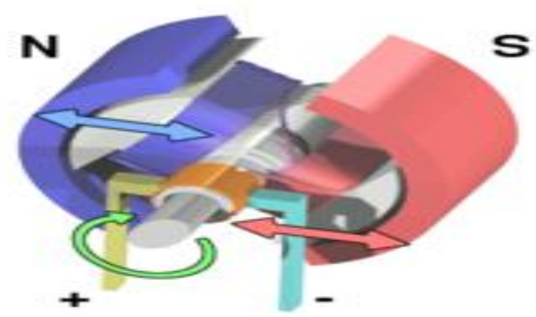

Fig 4.8 : Coiled DC Motor

Simple DC electric motor. When the coil is powered, a magnetic field is generated around the armature. The left side of the armature is pushed away from the left magnet and drawn toward the right, causing repulsion.

Wound field DC Motor

The permanent magnets on the outside (stator) of a DC motor may be replaced by electromagnets. By varying the field current it is possible to alter the speed/torque ratio of the motor. Typically the field winding will be placed in series (series wound) with the armature winding to get a high torque low speed motor, in parallel (shunt wound) with the armature to get a high speed low torque motor, or to have a winding partly in parallel, and partly in series (compound wound) for a balance that gives steady speed over a range of loads. Further reductions in field current are possible to gain even higher speed but correspondingly lower torque, called "weak field" operation.

Speed control

Generally speaking the rotational speed of a DC motor is proportional to the voltage applied to it, and the torque is proportional to the current. Speed control can be achieved by variable battery tappings, variable supply voltage, resistors or electronic controls. The direction of a wound field DC motor can be changed by reversing either the field or armature connections but not both, this is commonly done with a special set of contactors (direction contactors).

Effective voltage can be varied by inserting a series resistor or by an electronically-controlled switching device made of thyristor, transistors, or, historically, mercury arc rectifiers. In a circuit known as a chopper, the average voltage applied to the motor is varied by switching the supply voltage very rapidly. As the "on" to "off" ratio is varied to alter the average applied voltage, the speed of the motor varies. The rapid switching wastes less energy than series resistors. Output filters smooth the average voltage applied to the motor and reduce motor noise.

Since the series-wound DC motor develops its highest torque at low speed, it is often used in traction applications such as electric locomotives, and trams. Another application is starter motors for petrol and small diesel engines. Series motors must never be used in applications where the drive can fail (such as belt drives). As the motor accelerates the armature (and hence field) current reduces. The reduction in field causes the motor to speed up (see 'weak field' in the last section). As a consequence the motor's speed tends to infinity, but the motor will destroy itself before it spins that fast.

One interesting method of speed control of a DC motor was Ward-Leonard Control. It is a method of controlling a DC motor (usually a shunt or compound wound) and was developed as a method of providing a speed controlled motor from an AC supply, though it was not without its advantages in DC schemes. The AC supply is used to drive an AC motor, usually an induction motor that drives a DC generator or dynamo. The DC output from the armature is directly connected to the armature of the DC motor (usually of identical construction). The shunt field windings of both DC machines are excited via a variable resistor from the generator’s armature. This variable resistor provides extremely good speed control from standstill to full speed, and consistent torque.

4.5.2 Crank

The moving mechanism linked with the mechanism consists of an arm attached to a rotating disc that moves at a controlled uniform speed. In this manner the rotary motion will be converted in to vertical linear motion, here crank is playing major roll, this is called Crank slider mechanism.

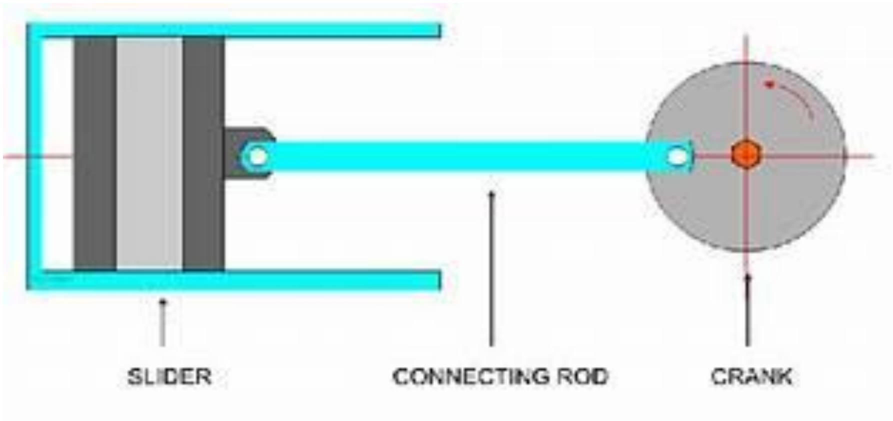

Fig 4.9: Crank

A crank is an arm attached at right angles to a rotating shaft by which reciprocating motion is imparted to or received from the shaft. It is used to convert circular motion into reciprocating motion, or vice versa. The arm may be a bent portion of the shaft, or a separate arm or disk attached to it. Attached to the end of the crank by a pivot is a rod, usually called a connecting rod. The end of the rod attached to the crank moves in a circular motion, while the other end is usually constrained to move in a linear sliding motion. The term often refers to a human-powered crank which is used to manually turn an axle, as in a bicycle crank set or a brace and bit drill. In this case a person's arm or leg serves as the connecting rod, applying reciprocating force to the crank. There is usually a bar perpendicular to the other end of the arm, often with a freely rotatable handle or pedal attached.

A quick return mechanism is an apparatus that converts circular motion (rotating motion following a circular path) into reciprocating motion (repetitive back-and-forth linear motion) in presses and shaping machines, which are utilized to shape stocks of metal into flat surfaces, throughout mechanical engineering. The quick return mechanism is the foundation behind the energy of these machines.

The mechanism consists of an arm attached to a rotating disc that moves at a controlled uniform speed. Unlike the crank, the arm of the mechanism runs at a different rate than the disc. By having the disc run at a different rate than the attached arm, productivity increases because the amount of time needed for a cut is reduced. The design of this mechanism specializes in vector calculus and the physical aspects of kinematics (study of motion without the effects of forces) and dynamics (study of forces that affect motion).

TYPES OF CRANKS

1. Side Crank
2. Cente crank

FUNCTIONS OF CRANK

1. It transmits power to the flywheel.
2. It receives power from the flywheel.
3. It converts the reciprocating motion into rotating motion

4.5.3 Sliding channel

Fig 4.10: Sliding Channels

A lot is made of the question ‘what is the difference between a slider and runner?’ but we find that they basically offer the same function – letting a drawer move in and out – and therefore we can use either name for anything that relates to this action. Although they have some minor technical differences both sliders and runners offer the same basic function, they both allow a drawer to move in and out smoothly. As a result, we and most other companies prefer to call products of this type a Drawer Slide for the sake of simplicity as slides and runners are essentially interchangeable terms. A ‘slide’ is generally the term that is given to a product that is fixed to the side of the drawer or any other mechanism and the carcass of the drawer unit. The movement in and out is facilitated by ball bearings, ensuring that movement is smooth and noiseless. Slides are generally used in heavy duty drawer systems as they are often more capable of supporting heavy weights than runners are.

Drawer Runners

A ‘runner’ is generally the term that is given to a product that is fixed to the bottom edge of the drawer and the carcass of the drawer unit. Much like the slide the movement in and out is facilitated by ball bearings, though usually smaller than the slider version and offering a smoother opening action. When fully extended runners often allow the drawer to be lifted and removed, allowing for easy access to the drawer system. Runners are usually not as robust as slides and are more often found in light kitchen and bedroom drawers.Some companies use one term, some use both all we'll say is it’s important to look at the function of the drawer rather than worrying about the name too much.

Fig 4.11: Drawer Runners

4.5.4 Key

A key or push-button is a simple switch mechanism for controlling some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, though even many un-biased buttons (due to their physical nature) require a spring to return to their un-pushed state. Different people use different terms for the "pushing" of the button, such as press, depress, etc.

The "push-button" has been utilized in calculators, push-button telephones, kitchen appliances, and various other mechanical and electronic devices, home and commercial. In industrial and commercial applications, push buttons can be connected together by a mechanical linkage so that the act of pushing one button causes the other button to be released. In this way, a stop button can "force" a start button to be released. This method of linkage is used in simple manual operations in which the machine or process have no electrical circuits for control.

Pushbuttons are often color-coded to associate them with their function so that the operator will not push the wrong button in error. Commonly used colors are red for stopping the machine or process and green for starting the machine or process. Red pushbuttons can also have large heads (called mushroom heads) for easy operation and to facilitate the stopping of a machine. These pushbuttons are called emergency stop buttons and are mandated by the electrical code in many jurisdictions for increased safety. This large mushroom shape can also be found in buttons for use with operators who need to wear gloves for their work and could not actuate a regular flush-mounted push button.

As an aid for operators and users in industrial or commercial applications, a pilot light is commonly added to draw the attention of the user and to provide feedback if the button is pushed. Typically this light is included into the center of the pushbutton and a lens replaces the pushbutton hard center disk. The source of the energy to illuminate the light is not directly tied to the contacts on the back of the pushbutton but to the action the pushbutton controls. In this way a start button when pushed will cause the process or machine operation to be started and a secondary contact designed into the operation or process will close to turn on the pilot light and signify the action of pushing the button caused the resultant process or action to start.

Fig 4.12: Push Button

4.5.5 DC MOTOR REGULATOR

DC motor speed control is one of the most useful features of the motor. By controlling the speed of the motor, you can vary the speed of the motor according to the requirements and can get the required operation.

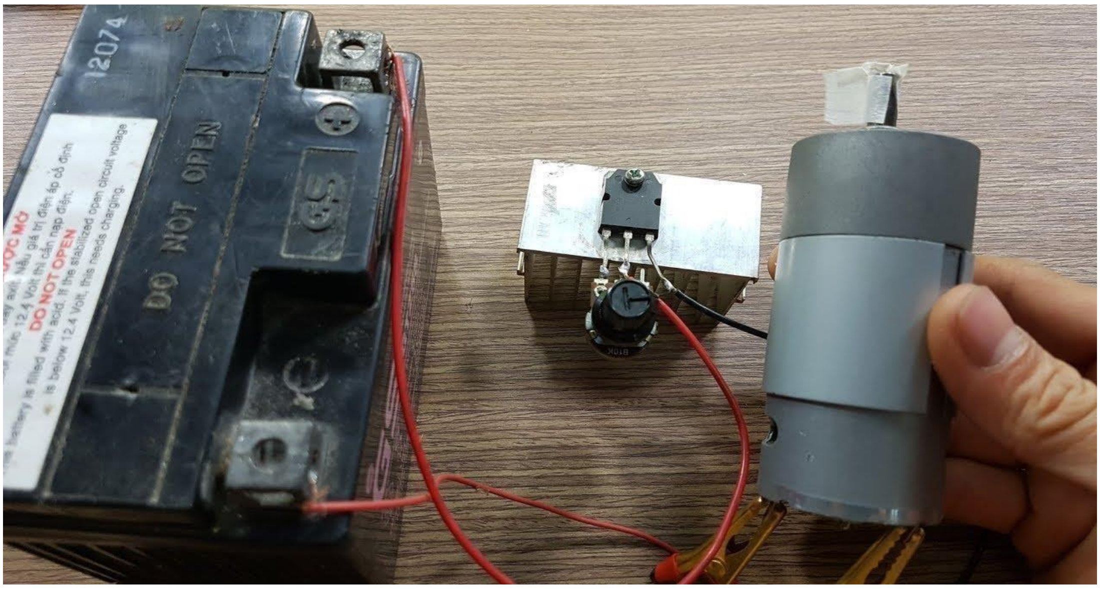

Fig 4.13: Motor regulator

4.5.6 Time dealy circuit

An electronic simulation device for reproduction of a signal with a delay equal to a predetermined time interval τ. Delay circuits are used in the simulation of technological processes associated with matter transfer or the channeling of power, in the approximation of equations describing complex objects, and as a component of certain automatic control and monitoring systems. For example, using a delay circuit connected to an electrical network it is possible to record not only a breakdown of the network but also the process preceding the occurrence of the breakdown. In actual practice τ can vary from fractions of a second to dozens of minutes. The operation of a delay circuit is based on the use of magnetic recording, the capability of electrical capacitors of retaining a charge, and an approximation of the transfer function in an ideal delay component.

In a magnetic delay circuit the time delay is proportional to the distance between the recording and playback heads. The delay is also inversely proportional to the linear speed of the data carrier. In capacitor delay circuits, signals are “memorized” in the form of an electrical charge of the capacitors that is proportional to the voltage level supplied to the circuit. The process of memorizing (delay) consists in the sequential switching of the voltage (signal) to the capacitors or the sequential transmission of the voltage through a series of capacitors. The data thus delayed are reproduced by sequential connection of the charged capacitors to a voltage indicator (a voltmeter or oscillograph) or are read out by recharging thfe last capacitor in the series. The delay time of a delay circuit is proportional to the number of capacitors and inversely proportional to the switching frequency. Electromechanical systems limit the ultimate switching speed and decrease the reliability of delay circuits; therefore, their use is feasible only for low-frequency input signals.

Fig 4.14: Time delay circuit

4.5.7 Control circuit

Control Circuits are key components in crafting Mechanism machines/tools. They are present in many recipes, and different recipes may require different tiers of Control Circuits. For example, an Energized Smelter would require Basic Control Circuits, but a Chemical Dissolution Chamber would require Ultimate Control Circuits. It's a Low-Power-Level (Signal level) open loop or closed loop circuit that controls the switching of switching devices (ex BJTs, SCRs, MOSFETs, IGBTs, GTOs) by providing a voltage or current pulse to the Gate / Base terminal of the switching devices.

A Gate Driver ic is generally used to generate gate voltage and current of sufficient magnitude (say 15V gate to source voltage and 1 Amp Gate current)

Control Signal input to the driver ic is generally a low power logic signal which can be derived from microcontrollers or from a closed feedback loop.

For closed loop control, PWM technique is generally adopted where control signal is generated by comparing the output of the power circuit with a reference signal and then comparing the error signal with a sawtooth /triangular waveform to generate a PWM signal which is then fed to the driver ic and finally to the gate of the devices.

Types of controls

1. Manual Control:

The link between the measuring element and the regulating unit is the human operator. In this type of control no automatic controls are used in the system. This type of system might be very simple to implement but the only drawback being that such a system needs constant human monitoring and vigilance.

2. Semi-Automatic Controls:

The human operator starts off a sequence of operations which are then carried out automatically in some predetermined manner. For example starting up an electric motor by pressing the start button or in start up a process in which the valves are operated in a definite sequence at fixed time interval by a timer.

3. Automatic control:

There is no human link between the measuring unit and the regulating unit. Hence the operator is replaced by the controller. This action is continuously variable and remote. Automatic control system is one in which the actual value of the controlled parameter (such as pressure, temperature, flow, level etc) is compared with a desired value and corrective action is taken.

4. Local control:

The regulating units is altered by means of a lever, hand wheel or other attachments fixed on the unit itself.

5. Remote control:

Some means of power transmission is used to connect the regulating unit to an actuating device mounted some distance away. The power transmission may be either through mechanical linkages, fluid linkages or electrical linkages.

Fig 4.15: Control circuit

4.6 WORKING PROCEDURE

1. The machine equipped with vertical crank sliding mechanism is motorized. A vertical stand with strong basement is required to hold the mechanism..

2. With the help of a smooth slider attached to the vertical stand, the utensil made with stainless steel mesh that holds food grains will be lowered and raised continuously.

3. When the vertical moving mechanism is attached to the crank slider, and when the motor is energized, the food grains utensil moves up and down with a force.

4. If a bucket of water kept under the utensil, the food grains will be dipped in to the water and lifted continuously, as this process continuous for 2-3 minutes, food grains will be cleaned systematically.

5. After completing the cleaning process, the utensil can be tilted to transfer the grains in toanother container.

6. The vertical moving mechanism is constructed with 30RPM dc motor, this motor is having built-in-with reduction gear mechanism internally such that speed will be reduced and torque will be increased.

7. The motor drive circuit is constructed with start-key, time delay circuit designed with switching transistor and energy storage capacitor, Relay, etc.

8. When the start key is activated, the capacitor charges through transistor and remains in charged condition for few seconds, until than the machine remains in energized condition, once the capacitor discharges, machine will be switched off automatically.

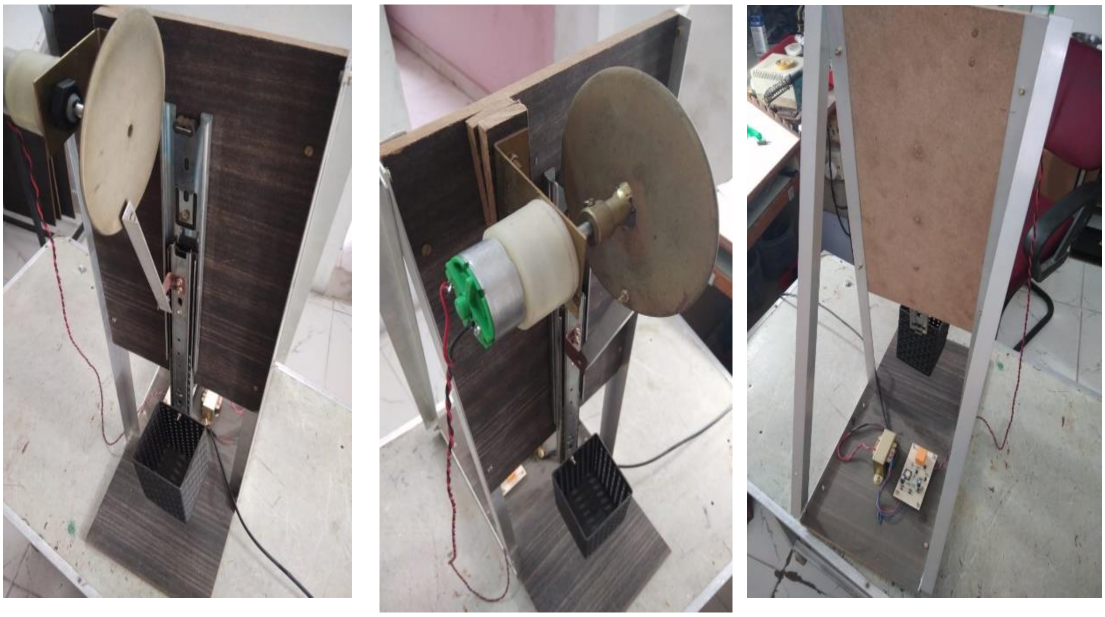

Fig 4.16: Proposed Model

CHAPTER-5

ADVANTAGES, DISADVANTAGES & APPLICATIONS

CHAPTER- 5
ADVANTAGES, DISADVANTAGES &APPLICATIONS

The advantages, disadvantages & applications of this proposed model are

5.1 ADVANTAGES

1. Easy to operate and carry.
2. Slow and safety operation.
3. Process cost is minimum.
4. Can reduce man power.
5. Different grains should be cleaned.
6. Improves sanitation and dust control.
7. Increases storage life of grain.
8. Skilled labor is not required.

5.2 DISADVANTAGES

1. It needs electric power.
2. High amount of grains are not cleaned at a time.
3. Large weight of grains are not allowed.
4. Due to size of grains, the container may be changed.

5.3 APPLICATIONS

1. Mostly this technique is used for cleaning purpose.
2. It is used for cleaning grains in the kitchen.
3. It is used for chefs in hotels for cleaning the cutlery like plates,spoons.
4. The same system can also be used for domestic applications.

CHAPTER-6

RESULTS AND DISCUSSION

CHAPTER-6
RESULTS AND DISCUSSION

All the objective had been fulfilled successfully and thus we are able to made a food grains cleaning machine to clean the grains. Food grains cleaning machine is designed with a motor, crank, connecting rod, sliding channel and grains container. The system is capable of to clean the grains. The photo of our project is shown above, thus the food grains cleaning machine is helpful to chefs in hotels and women's in domestic kitchen. It is safer and takes very less time. The existing technologies were very much costlier than the cost of our project. We have used light weighted motors so that the system is not heavy and also it is precise.

6.1 Calculation of power

P = Power Units : Watts

V = Voltage Units : Volt

I = Current Units : Ampere

T = Time Units : Seconds

P = V*I

6.2 EXPERIMENTAL RESULTS ON DIFFERENT FOOD GRAINS

1. Ground nut seeds
2. Pulses
3. Horse gram
4. Green gram
5. Rice

Table 6.1: Experimental results on ground nut seeds

SL.NO	Trail (kg)	Voltage (V)	Current (I)	Power (P)	Time (Sec)
1	1	4.1	0.62	2.54	38
2	2	4.9	0.70	3.43	74
3	3	5.8	0.78	4.52	104
4	4	6.7	0.87	5.82	142
5	5	7.5	0.95	7.12	180

Calculations:

- **For 1 kg**

P=V*I
P=4.1*0.62
P=2.54

- **For 2 kg**

P=V*I
P=4.9*0.70
P=3.43

- **For 3 kg**

P=V*I
P=5.8*0.78
P=4.52

- **For 4 kg**

P=V*I
P=6.7*0.87
P=5.82

- **For 5 kg**

P=V*I
P=7.5*0.95
P=7.12

Table 6.2: Experimental results on Pulses

SL.NO	Trail (kg)	Voltage (V)	Current (I)	Power (P)	Time (Sec)
1	1	4.7	0.68	3.19	42
2	2	5.5	0.75	4.12	83
3	3	6.4	0.83	5.31	120
4	4	7.3	0.89	6.49	166
5	5	8.1	0.97	7.85	205

Calculations:

- **For 1 kg**

P=V*I
P=4.7*0.68
P=3.19

- **For 2 kg**

P=V*I
P=5.5*0.75
P=4.12

- **For 3 kg**

P=V*I
P=6.4*0.83
P=5.31

- **For 4 kg**

P=V*I
P=7.3*0.89
P=6.49

- **For 5 kg**

P=V*I
P=8.1*0.97
P=7.85

Table 6.3: Experimental results on Horse gram

SL .NO	Trail (kg)	Voltage (V)	Current (I)	Power (P)	Time (Sec)
1	1	4.9	0.71	3.47	52
2	2	5.6	0.77	4.31	104
3	3	6.5	0.84	5.46	152
4	4	7.3	0.93	6.78	194
5	5	8.2	1.00	8.2	240

Calculations:

- **For 1 kg**

P=V*I
P=4.9*0.71
P=3.47

- **For 2 kg**

P=V*I
P=5.6*0.77
P=4.31

- **For 3 kg**

P=V*I
P=6.5*0.84
P=5.46

- **For 4 kg**

P=V*I
P=7.3*0.93
P=6.78

- **For 5 kg**

P=V*I
P=8.2*1.00
P=8.2

Table 6.4: Experimental results on Green gram

SL. NO	Trail (kg)	Voltage (V)	Current (I)	Power (P)	Time (Sec)
1	1	5.3	0.74	3.92	56
2	2	6.2	0.83	5.14	113

3	3	6.9	0.90	6.21	167
4	4	7.6	0.97	7.37	218
5	5	8.4	1.03	8.65	270

Calculations:

- **For 1 kg**

  P=V*I
  P=5.3*0.74
  P=3.92

- **For 2 kg**

  P=V*I
  P=6.2*0.83
  P=5.14

- **For 3 kg**

  P=V*I
  P=6.9*0.90
  P=6.21

- **For 4 kg**

  P=V*I
  P=7.6*0.97
  P=7.37

- **For 5 kg**

  P=V*I
  P=8.4*1.03
  P=8.65

Table 6.5: Experimental results on Rice

SL. NO	Trail (kg)	Voltage (V)	Current (I)	Power (P)	Time (Sec)
1	1	5.6	0.77	4.31	62
2	2	6.5	0.86	5.59	126
3	3	7.5	0.96	7.2	195
4	4	8.4	1.03	8.6	248
5	5	9.2	1.08	9.93	300

Calculations:

- **For 1 kg**

  P=V*I
  P=5.6*0.77
  P=4.31

- **For 2 kg**

  P=V*I
  P=6.5*0.86
  P=5.59

- **For 3 kg**

  P=V*I
  P=7.5*0.96
  P=7.2

- **For 4 kg**

  P=V*I
  P=8.4*1.03
  P=8.6

- **For 5 kg**

  P=V*I
  P=9.2*1.08
  P=9.93

From the above table 6.1, 6.2, 6.3, 6.4, 6.5 shows the experimental results containing of kgs voltage, current, power and time.

6.3 Comparison of Above Food Grains Between Power And Weight

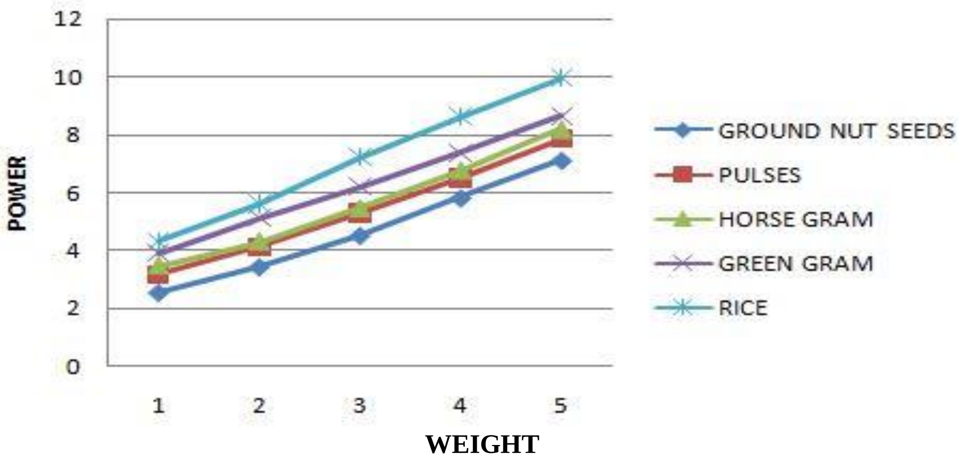

Fig 6.1: Plot between power and weight

6.4 Comparison of above food grains between time and weight

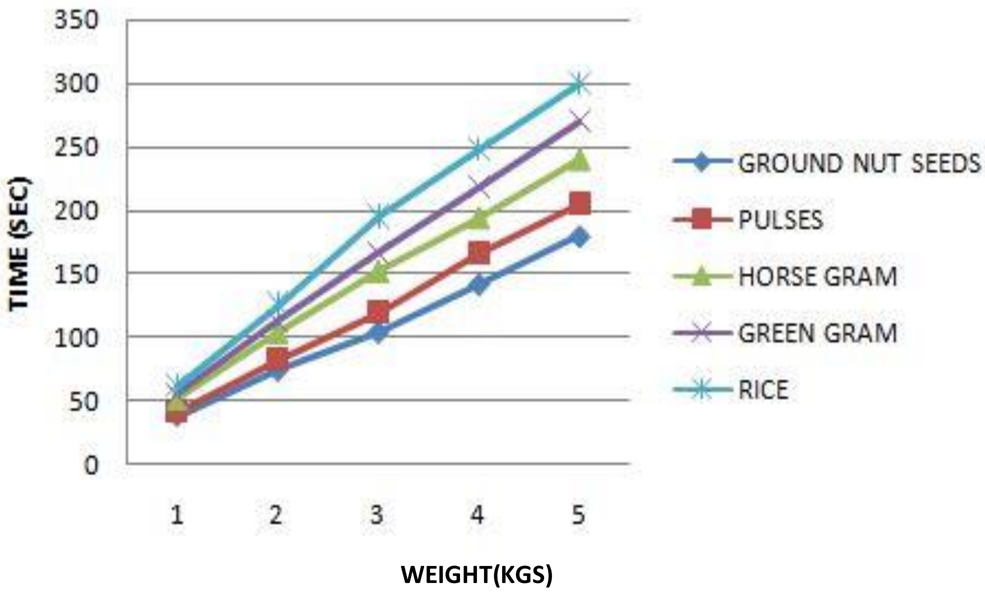

Fig 6.2: Plot between time and weight

Figc6.1, 6.2 are the comparison between 5 different types of food grains of having power and weight, time and weight. If the grains having large size, the time taken is less. Where the grains having low size, time taken is high, The graph shows the variations and also if the weight increases, the time taken also increases.

CHAPTER-7

CONCLUSION

CHAPTER-7

CONCLUSION

The project work “food grains cleaning machine” designed and developed successfully, results are found to be satisfactorily. The whole machine is constructed with locally available components, especially the mechanical components used in this project work are procured from mechanical fabricators, and they are not up to the requirement, few modifications must be carried out in design & is essential to make it as real working system. Hence, the machine is to be enhanced further for obtaining better results. But it is not fully automated, to make it fully automated after cleaning the material, the material holding container must be tilted in opposite direction by which unwanted sand can be delivered in other direction automatically. This we will try to implement in our future work.

Here in this project we observed one thing that is, if the size of the grain will increase then the power required to clean the grains is decreases and if the size of grains decreases then the time taking to clean the grains will be increases.

The system designed here can be used for cleaning applications, any type of food grains or any type mechanical components like nuts, screws, etc. can be cleaned effectively. In addition when this system is used in hotels it can be used to clean the cutlery items like spoons, plates, cups, glasses, etc. The same system also can be used in industries for cleaning the specific machinery parts.

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REFERENCE

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