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DEVELOPMENT OF AN AUTOMATIC FOOD PACKGING SYSTEM

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Abstract- *Food packaging is packaging for food. It requires protection, tampering resistance, and special physical, chemical, or biological needs. It also shows the product that is labeled to show any nutrition information on the food being consumed. The aim of this project is to design, fabrication and implementation of a automatic control food packing system model. The fabricated machine/system can transfer the food product like fruits, drinks and other solid products from production place to the packaging place as well as counting them upto definite number and finally packing those items in the particular box for storing and shipment. The overall performance of the fabricated system is good.*
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Keywords: Food Packaging, Nutrition, Robot, Sensor and autonomous

1. INTRODUCTION

Food packaging is packaging for food. It requires protection, tampering resistance, and special physical, chemical, or biological needs. It also shows the product that is labeled to show any nutrition information on the food being consumed.

Packaging has several objectives:

- **Physical protection** - The food twerk enclosed in the package may require protection from, among other things, shock, vibration, compression, temperature, etc.
- **Barrier protection** - A barrier from oxygen, water vapor, dust, etc., is often required. Permeation is a critical factor in design. Some packages contain desiccants or Oxygen absorbers to help extend shelf life. Modified atmospheres or controlled atmospheres are also maintained in some food packages. Keeping the contents clean, fresh, and safe for the intended shelf life is a primary function.
- **Containment or agglomeration** - Small items are typically grouped together in one direction package for reasons of efficiency. powders, and granular materials need containment.
- **Information transmission** - Packages and labels communicate how to use, transport, recycle, or dispose of the package or product. Some types of information are required by governments.
- **Marketing** - The packaging and labels can be used by marketers to encourage potential buyers to purchase the product. Package design has been an important and constantly evolving phenomenon for several decades.

  Marketing communications and graphic design are applied to the surface of the package and (in many cases) the point of sale display.
- **Security** - Packaging can play an important role in reducing the security risks of shipment. Packages can be made with improved tamper resistance to deter tampering and also can have tamper-evident features to help indicate tampering. Packages can be engineered to help reduce the risks of package pilferage: Some package constructions are more resistant to pilferage and some have pilfer indicating seals. Packages may include authentication seals to help indicate that the package and contents are not counterfeit. Packages also can include anti-theft devices, such as dye-packs, RFID tags, or electronic article surveillance tags, that can be activated or detected by devices at exit points and require specialized tools to deactivate. Using packaging in this way is a means of retail loss prevention.
- **Convenience** - Packages can have features which add convenience in distribution, handling, stacking, display, sale, opening, reclosing, use, and reuse.
- **Portion control** - Single serving packaging has a precise amount of contents to control usage. Bulk commodities (such as salt) can be divided into packages that are a more suitable size for individual households[1].

The aim of this research is to design an autonomous food packaging machine/system and assembles these to complete the machine construction and to interface the

robot with micro controller using programming language, i.e. to control the system by micro controller for automatic movement.

2. DESIGN AND CONSTRUCTION OF THE PACKEGING SYSTEM

The most important portion of this project is the part of construction and implementation. This autonomous food packaging machine model is designed as pre programmed with the help of computer interfacing. We used micro controller to control the two stepper motors and three LDR sensors circuit to detect and, counting the product . Two power transistor circuits are used here to switching the stepper motors (Fig.1).

2.1 Mechanical Construction

The mechanical construction consists of a base, two platform one for products and one for packets made of wood with gear mechanism. A flat surface plate made of plywood is used as the base of the system where the stepper motor, circuit box, battery boxes are fixed on the surface of the base. Clamps are used to hold the stepper motors and the batteries with the base. Two conveyor belts operated by stepper motor are used to gradual movement of the products and packet box. All of the joints here made with nuts and bolts and all nuts and bolts are of SS metal.

Materials of mechanical construction are

1. Ply & hard wood
2. Rack & Pinion
3. Nuts and bolts
4. MS metal pins
5. Belts
6. Bearing
7. Screw
8. Steel Shafts

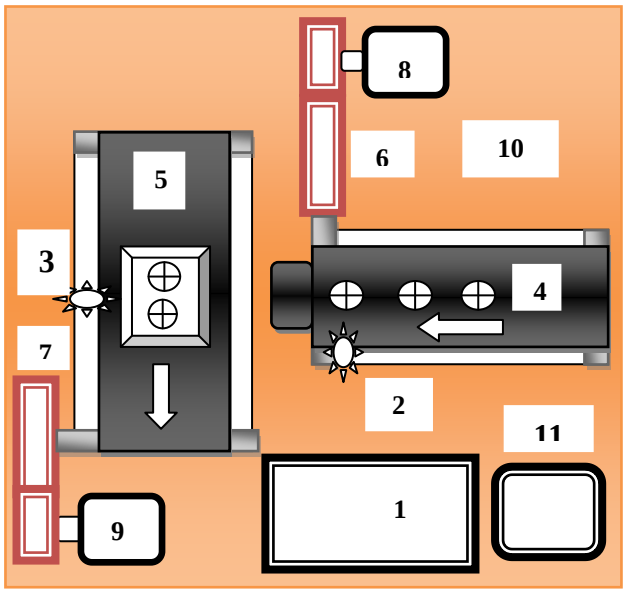

Fig.1 Schematic view of the food packaging system. The complete design of the system (Top view): 1: Circuit box, 2: Sensor-1, 3:Sensor-2, 4: Conveyor belt-1 , 5: Conveyor belt-2 6: Gear & pinion-1, 7: Gear & pinion-2, 8: Stepper motor-1, 9: Stepper motor -2, 10: Ply wood base and 11: Battery

2.2 Electrical Construction

The electrical construction consists of stepper motor and its controller, LDR based color sensor circuit and transistor switching circuit. A voltage comparator op-amp is also used in the color sensor.

Integrated circuits contain transistors, capacitors, resistors and other parts packed in high density on one chip. Although the function is similar to a circuit made with separate components, the integral structure of the components are different in an integrated circuit (Fig.2).

In this project we used two IC, one op-amp IC (LM324) and a micro controller IC (PIC 16F72)[2].

Materials of electrical construction are

1. Stepper motor
2. Crystal: 20MHz
3. 3 volt red LED
4. IC base
5. Vero board
6. Electric wires
7. Battery: 6V,
8. Microcontroller: PIC16F72A
9. LDRs
10. Op-Amp: LM 324
11. Transistor: BD 135 (NPN)
12. Resistance:330Ω,10kΩ
13. Capacitor:1000µFt[3]
14. MOSFET switch [4]

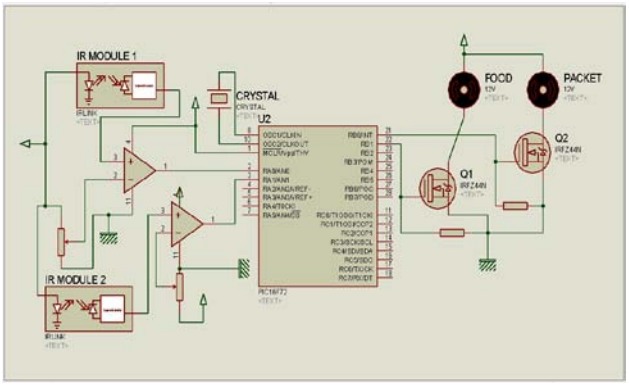

Fig.2 Electrical circuit of the packaging system : PIC 16F72 and LM324[5]

3. METHODOLOGY

According to our aims first the autonomous food packaging machine model is designed as pre programmed with the help of computer interfacing**.** Then we made a platform of hard and plywood where the other parts are attached by nuts & bolts. There are two conveyor belts: one carries foods and other carry packets. The belt which carries packets is attached on the platform directly. The other belt which carries food is implemented on the platform by four lags. The stepper motors are coupled with gear and shaft of the conveyor belt. Stepper motors are mounted on the platform. We use bracket made of steel to clamped the motors with wooden base (Fig.3).

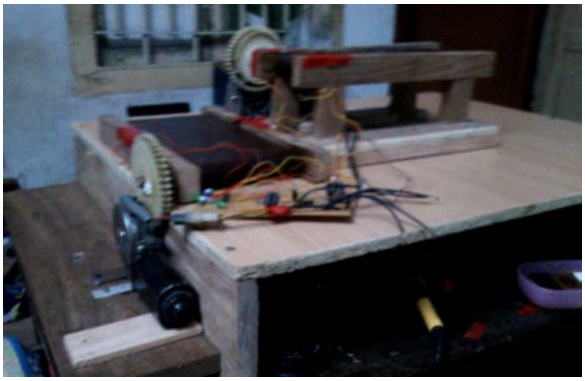

Fig.3 Three dimensional view of the food packaging system

We used here the logic of differential moving of conveyor belt to follow the detecting and counting the food product and packing box. The sensor circuit (see Electrical Construction) has two LDR (for counting food product and detecting packing box). The reflected light of LEDs from the food product and box falls on the LDR and the LDR shows various resistances. We measured the resistance of LDR when light reflects from the food product and box. Reflected light from other color gives various resistances by the LDR. So this resistance difference gives relative movement of the conveyor belt. Thus the system maintains its packing box position for storing food product correctly (Fig.4).

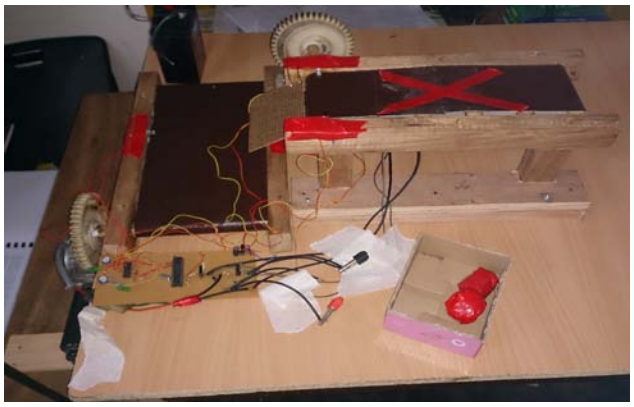

Fig.4 Three dimensional view of the food packaging system

Programming Language and Flow Chart

Programming language C is used here. The flow chart is given in the Fig.5.

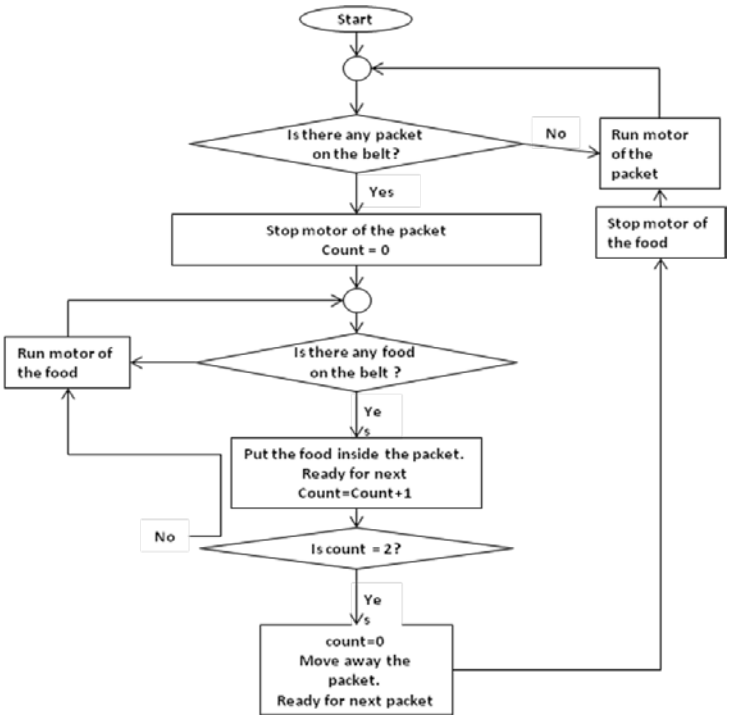

Fig 5: Flow chart of the food packaging system

4. DISCUSSION

With the help of computer the autonomous food packaging machine model is designed as pre programmed. Then we have completed our fabrication works as per designed. There are two conveyor belts: one carries foods and other carry packets. The stepper motors are coupled with gear and shaft of the conveyor belt.

The different color sensors measured the different light intensity and the sensor circuit sends signal to the micro controller. Then the micro controller drives the actuators according to the input signal and programmed logic.

The model automatic food packaging has run successfully. It can easily control the relative movement of the actuators (stepper motors) as well as the conveyor belts. It can easily count the definite number of food product as well as to control the movement of the food product storing box by the appropriate sensors. All process are automatically done by the pre set program of the micro controller.

5. CONCLUSION

From the above aim and discussion the following conclusion can be drawn

1. It control the relative movement of the stepper motor as well as the movement of the conveyor.
2. It can easily count the food product correctly
3. It can also control the time of stay of the empty box for storing the food product as well as the movement the box after finishing the storing work.

6. REFERENCES

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