International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 03 | Mar 2019 www.irjet.net p-ISSN: 2395-0072

DEVELOPMENT OF A SMART FLIPPING SYSTEM

Ishika Aggarwal[1], Nimeshka Faujdar[2], Shivam Verma[3], Pradeep Khanna[4]

[1, 2, 3] *Students, MPAE Division, NSUT, New Delhi, India*
[4] *Associate Professor, MPAE Division, NSUT, New Delhi, India*

Abstract – *The automated assembly lines have become indispensible in carrying out mass production processes. In many instances, the individual product needs to be shifted onto another conveying line with orientation upside down. Such requirements can be witnessed in printing applications and processing of panels. Normally they are affected either manually or through a complicated and costly pick and place system. The present system has been developed as an attempt to provide a simple and cost effective solution to such a requirement. The system consists of a rotary disc with radial slots stationed between two conveyors. The product in present cases is a laminated solar cell of standard dimension (6"x6") which has to be transferred from one conveyor to the other in an orientation upside down for further processing. Two IR sensors have been used to detect presence and absence of the product in the input and output slots of the rotary disc. Based on the programming, decision is taken to rotate the disc in the direction of flow to perform the desired task. Arduino UNO microcontroller has been used which controls two DC motors, one stepper motor and a linear actuator and has proved to be giving satisfactory performance of the system.*

Key Words: Automated assembly lines, indispensible, solar cells, Programming decision, microcontroller,

1. INTRODUCTION

Automation is a key technology necessary for improving the quality and quantity of products [1]. There are many instances on industrial level generally dealing with card shaped laminae. When the same needs to be turned upside down for necessary actions to be taken on other face. The task is generally performed by manual efforts in small to medium sized industries and is performed with the help of vacuum assisted or mechanical pick and place systems which are complicated, costly and require considerable maintenance. To remain competitive, there is a need to produce products at lower prices and higher quality [2]. Increase in competition has formed the need for innovation [3]. In the present work an attempt has been made to come out with a radically different design where the requirement of pneumatic components, vacuum generation and mechanical gripping/holding systems has been done away with while dealing with products like solar cells. The developed system rather provides a relatively simple, easy to operate and a cheaper alternative to such applications. The speed of the system can be altered to match the production rate making it flexible with less floor area requirements.

2. THE DESIGN SETUP

The actual working model of the developed system is shown in figure 1 and 2.

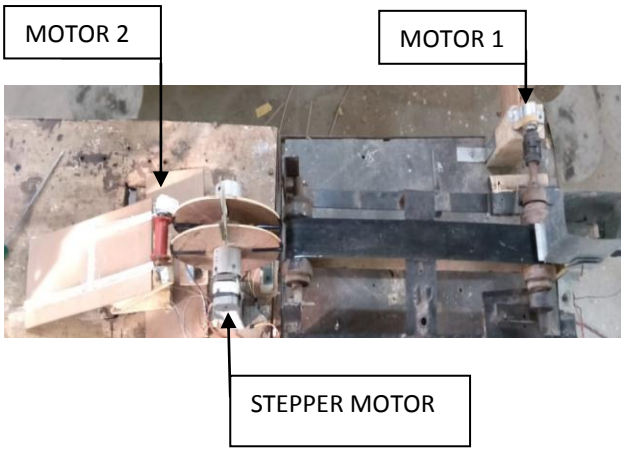

Fig-1 Top view of the setup

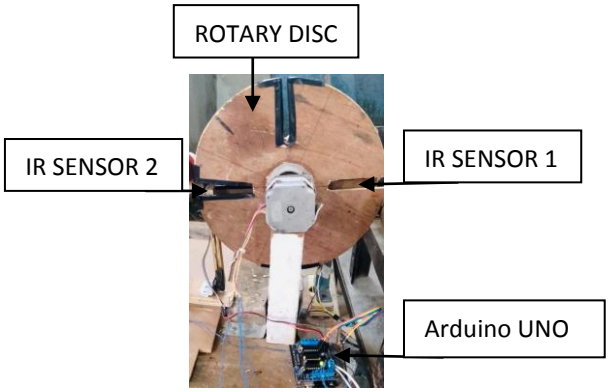

Fig-2 Rotary disc with the sensing part

The setup can be explained by dividing it into following three segments:

A. Sensing part

It consists of two numbers of IR Sensors used to detect the presence and absence of the product i.e. solar cells.

B. Actuation part

It consists of following hardware items:

a. Two numbers of dc motors are used to drive the input and output conveyors.

b. One stepper motor is used to rotate the slotted disc at a speed matching with the production.

C. The control part

The Arduino UNO microcontroller is used to run the logic whose code is given in the later section of this work.

3. WORKING

The working of the setup can be explained in the following steps

1. The IR sensor checks the presence of the component at the inlet and outlet slots of the rotary discs.
2. If both the sensors register no product, input conveyor starts and fed the product to the slot of rotary-disc.
3. The status is again checked by the sensor with output sensor registering zero and input sensor registering one, the disc rotates by 90 degrees bringing another free slot in front of input conveyor.
4. Status is again checked and situation one is observed causing input conveyor to feed another product into the free slot of the disc.
5. Status is checked again and situation of step two is observed causing the disc to rotate further by 90 degrees. By now the product in the previous slot is positioned on conveyor 2 through a total rotation of 180 degrees.
6. Status is checked again with input sensor registering zero and output sensor registering one. This triggers the rotation of motor 2 making the conveyor 2 to run and taking the product at output slot in upside down inverted position for further processing. This brings the system back to stage one and so on.

The working can also be understood conveniently by a process flow chart given in figure 3.

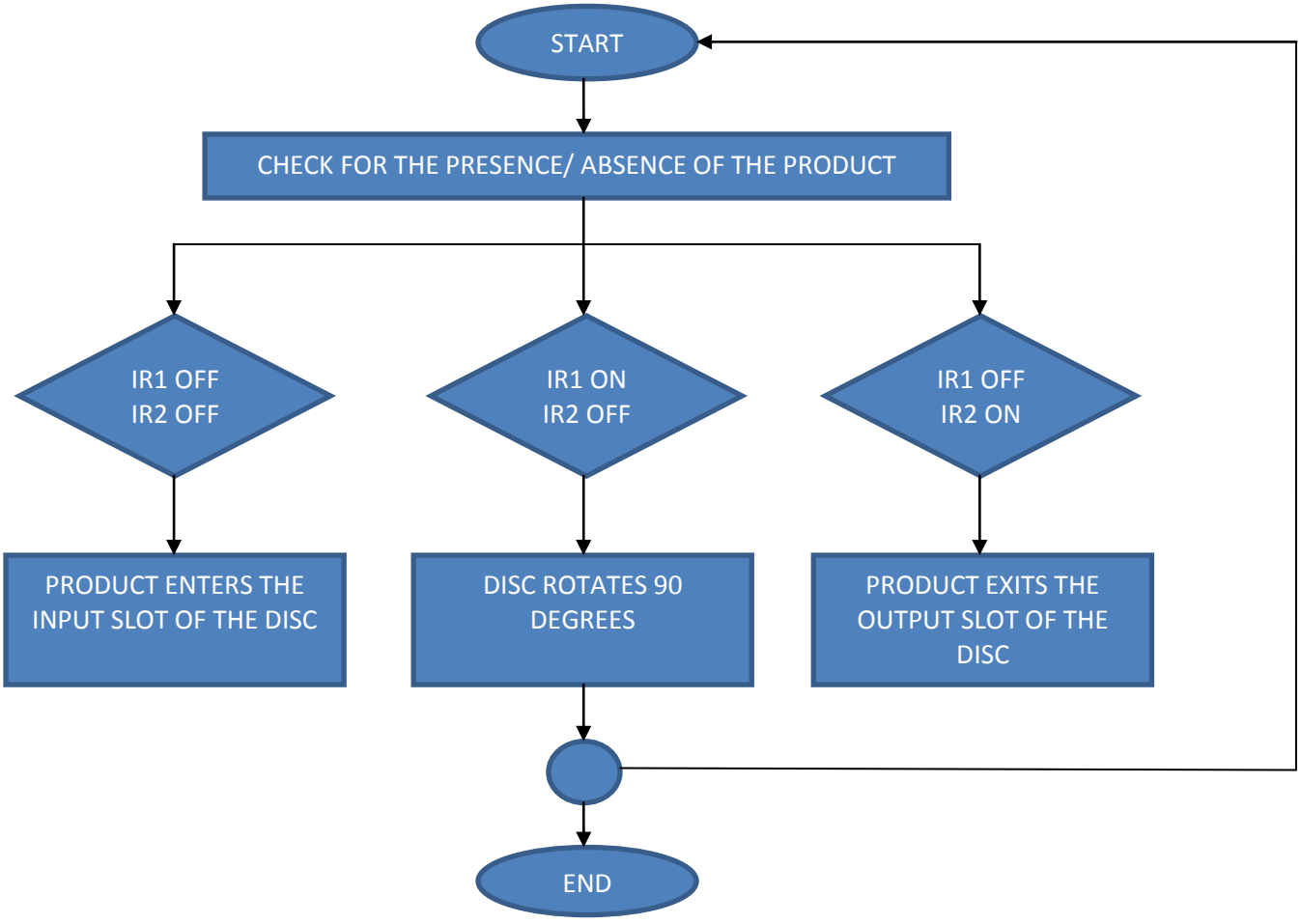

Fig-3 Flow Chart for the system

4. CONTROL PROGRAM

```
void setup() {
 Serial.begin(9600);    // set up Serial library at 9600 bps
motor.setSpeed(40);  // 10 rpm
 actuator.setSpeed(250);
conyer.setSpeed(110);
 actuator.run(RELEASE);
 conyer.run(RELEASE);
 rotateStepper();
  delay(1000);
  motor.release();

// ------------PINS FOR IR SENSORS----------------
  pinMode(firstIrPin,INPUT);
 pinMode(secondIrPin,INPUT);
 }
void loop() {
firstIrResult=digitalRead(firstIrPin);
Serial.println("firstIrResult");
Serial.println(firstIrResult);
secondIrResult=digitalRead(secondIrPin);
Serial.println("secondIrResult");
Serial.println(secondIrResult);
if(firstIrResult==1&&secondIrResult==1)
{
  pushPlate();
}

if(firstIrResult==0&&secondIrResult==1)
{
  rotateStepper();
  delay(1000);
}
if(firstIrResult==1&&secondIrResult==0)
{
  motor.release();
  conyer.run(BACKWARD);
delay(3000);
 rotateStepperC();
  conyer.run(RELEASE);


}

}
void rotateStepper()
{
  motor.step(50.5,BACKWARD, SINGLE);
  motor.release();}
void pushPlate()
{
actuator.run(FORWARD);
  delay(2000);
  actuator.run(BACKWARD);
 delay(1000);
  actuator.run(RELEASE);
}
```

5. RESULT

The developed system has been tested for its effected working and is found to be giving satisfactorily performance.

6. CONCLUSIONS

The following conclusions can be drawn from the work carried out so far.

1. The controller Arduino UNO has been found to give adequately competent to perform such kind of task.
2. The complexity, cost and space requirement of the developed system is considerably less than the conventional one.
3. The speed of the system can easily be varied steplessly.
4. If commercialized, the system with minor modification can successfully be used even in small scale industries owning to its discussed features.

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