TASK 3: Automation System Design Report

This report presents the design and explanation of three automated systems: 1. Smart Home Lighting System 2. Conveyor Belt with Sensor 3. Automated Packaging System Each system includes a flowchart representing logical operation and a circuit diagram showing hardware connections.

Introduction

Automation systems are widely used in modern homes and industries to improve efficiency, accuracy, safety, and productivity. These systems reduce human effort by using sensors, controllers, and actuators to perform tasks automatically. This report explains the design and working of three automated systems:

1. Smart Home Lighting System
2. Conveyor Belt with Sensor
3. Automated Packaging System

Each system is explained with its working principle, components used, flow of operation, and advantages.

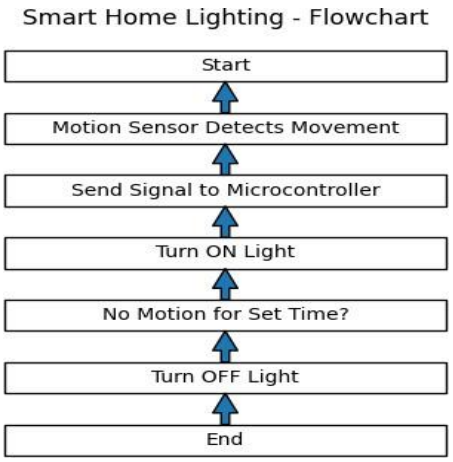
1. Smart Home Lighting System

The smart home lighting system uses a motion sensor to detect human presence. The sensor sends a signal to a microcontroller (such as Arduino). The controller processes the signal and activates a relay module that turns on the light. When no motion is detected for a predefined time, the controller turns off the light to save energy. This system improves energy efficiency, safety, and automation in residential buildings.

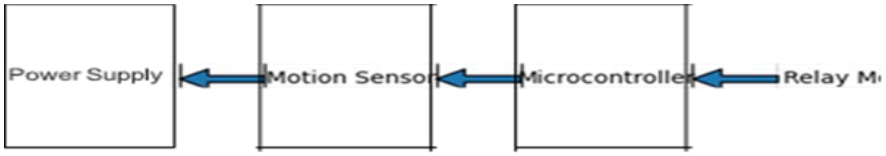
A Smart Home Lighting System is an automated system that controls lights based on motion detection. The system automatically turns ON the lights when a person enters a room and turns them OFF when no movement is detected for a certain time. This helps in saving electricity and increasing convenience.

Main Components

- Power Supply
- Motion Sensor (PIR Sensor)
- Microcontroller (Arduino or similar)
- Relay Module
- LED or Bulb



Smart Home Lighting - Circuit Diagram



Working Principle

The system works on motion detection technology. A Passive Infrared (PIR) sensor detects infrared radiation emitted by the human body. When a person enters the room, the sensor detects motion and sends a signal to the microcontroller.

The microcontroller processes this signal and activates the relay module. The relay acts as a switch and turns ON the light. When no movement is detected for a predefined time (for example, 30 seconds or 1 minute), the microcontroller sends a signal to deactivate the relay, which turns OFF the light.

Flow of Operation

1. System starts.
2. Motion sensor checks for human movement.
3. If motion is detected, signal is sent to microcontroller.
4. Microcontroller activates relay.
5. Light turns ON.
6. If no motion is detected for a set time, relay is deactivated.
7. Light turns OFF.
8. System returns to monitoring mode.

Applications

- Homes
- Offices
- Corridors
- Parking areas

Advantages

- Saves electricity
- Reduces human effort
- Increases safety Cost-effective
- Easy installation

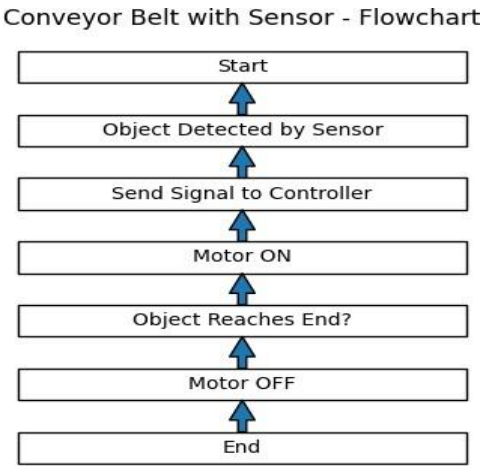
2. Conveyor Belt with Sensor

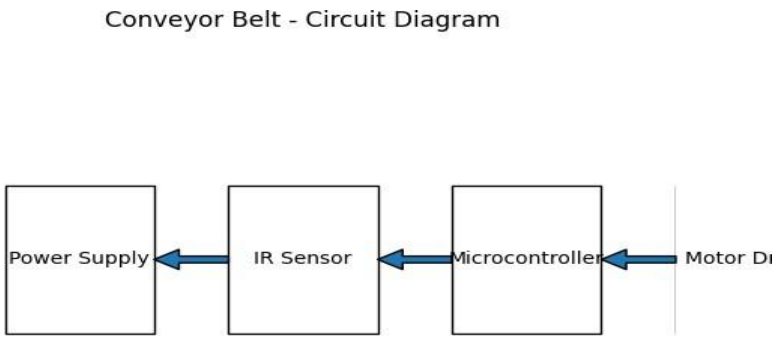
The conveyor belt system uses an IR sensor to detect objects placed on the belt. When an object is detected, the microcontroller activates a motor driver to run the DC motor. The belt moves the object to the required position. Once the object reaches the endpoint or another sensor detects it, the controller stops the motor. This system is widely used in manufacturing and material handling industries.

A Conveyor Belt with Sensor system is an automated material handling system used in industries. It transports objects from one place to another using a motor-driven belt. Sensors detect the presence of objects and control the movement of the belt.

Main Components

- Power Supply
- IR Sensor
- Microcontroller
- Motor Driver
- DC Motor
- Conveyor Belt





Working Principle

The IR (Infrared) sensor detects objects placed on the conveyor belt. When an object is detected, the sensor sends a signal to the microcontroller.

The microcontroller processes the signal and activates the motor driver. The motor driver supplies sufficient current to the DC motor, which rotates and moves the conveyor belt. The object travels along the belt.

When the object reaches the end of the belt or another sensor detects its position, the microcontroller stops the motor. This ensures controlled and automated movement of materials.

Flow of Operation

1. System starts.
2. IR sensor checks for object presence.
3. If object detected, signal sent to controller.
4. Motor driver activated.
5. DC motor rotates.
6. Conveyor belt moves object forward.
7. When object reaches destination, motor stops.
8. System waits for next object.

Applications

- Manufacturing industries
- Packaging industries
- Airports (baggage systems)
- Warehouses

Advantages

- Reduces manual labor
- Increases production speed
- Improves accuracy
- Continuous operation possible
- Safe material handling

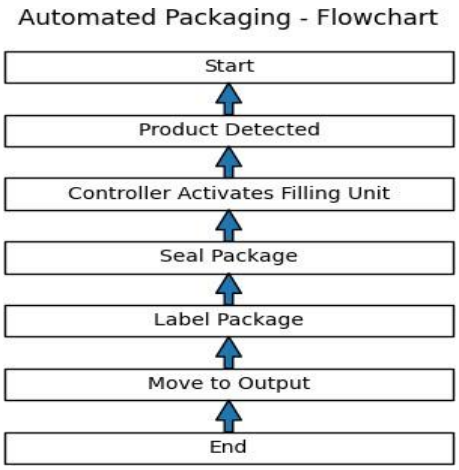
3. Automated Packaging System

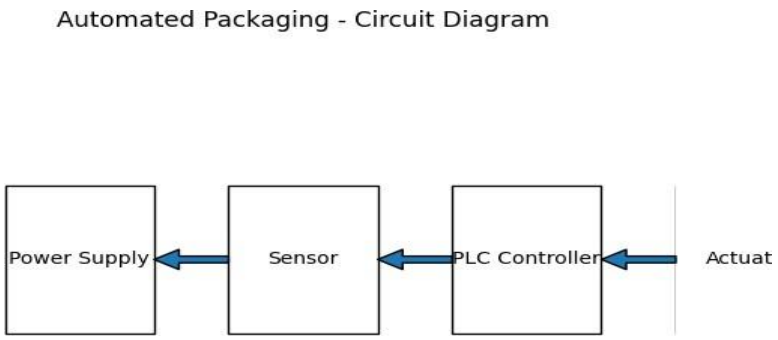
The automated packaging system detects a product using sensors. A PLC or controller activates actuators responsible for filling, sealing, and labeling the package. Motors and pneumatic actuators perform mechanical tasks. The system increases production speed, reduces human error, and ensures consistent packaging quality. It is commonly used in food, pharmaceutical, and manufacturing industries.

An Automated Packaging System is used in industries to pack products automatically. It performs operations such as filling, sealing, labeling, and moving packages without manual intervention. This system improves production speed and packaging quality.

Main Components

- Power Supply
- Sensors (Proximity or IR)
- PLC (Programmable Logic Controller) or Microcontroller
- Actuators
- Sealing Motor
- Conveyor System





Working Principle

The system begins by detecting the presence of a product using sensors. When a product is detected, the controller (PLC or microcontroller) activates the filling unit to fill the product into the package.

After filling, the sealing unit seals the package using heat or pressure. Then the labeling unit attaches a label to the package. Finally, the conveyor moves the finished package to the output section.

All operations are performed automatically according to programmed instructions in the controller.

Flow of Operation

1. System starts.
2. Product detected by sensor.
3. Controller activates filling unit.
4. Package is filled.
5. Sealing process starts.
6. Package is sealed.
7. Label applied.

8. Package moved to output.
9. System repeats process.

Applications

- Food industry
- Pharmaceutical industry
- Cosmetic industry
- Consumer goods manufacturing

Advantages

- High production speed
- Consistent packaging quality
- Reduced human error
- Cost-efficient in long term
- Improved safety and hygiene

Conclusion

Automation systems play a major role in modern homes and industries. The Smart Home Lighting System improves energy efficiency and convenience in residential buildings. The Conveyor Belt with Sensor enhances industrial material handling by automating object movement. The Automated Packaging System increases production efficiency and ensures high-quality packaging.

All three systems use basic automation components such as sensors, controllers, motors, and actuators. By combining hardware and logical programming, these systems reduce manual effort, increase productivity, and improve reliability.

Automation technology continues to grow and will play an even more important role in future smart homes and industries.