

PROJECT REPORT

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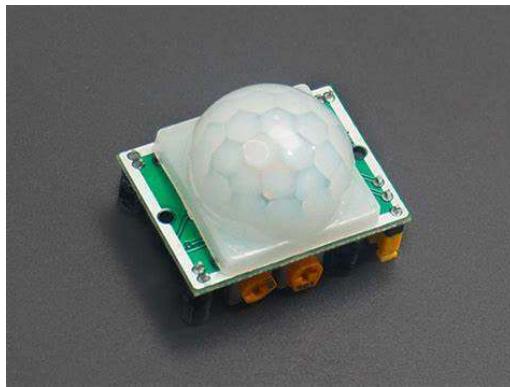
ADITYA SHARMA 2023MEB1325

DETAILED DESCRIPTION OF EACH MATERIAL USED IN THE PROJECT

PIR SENSOR (Panasonic EKMC 1601111)

Panasonic

Authorized distributor



A PIR (Passive Infrared) sensor detects motion by sensing infrared radiation from objects, especially humans. It triggers output when movement changes detected IR levels. PIR sensors are highly energy-efficient, consuming minimal power, making them ideal for battery-operated systems. They are cost-effective and widely used due to their affordability. By detecting human presence based on body heat, they reduce false triggers from inanimate objects, ensuring reliable operation. Additionally, their simple design allows easy integration with microcontrollers and automation systems.

MICROWAVE SENSOR (HB100)



A **microwave sensor** detects motion using the **Doppler effect**, analyzing frequency shifts in reflected microwave signals. It offers a **longer range**, works in **all conditions** (darkness, fog, through walls), and detects **small movements**. Microwave sensors offer a longer detection range compared to PIR sensors, making them suitable for larger areas. They function effectively in all conditions, including darkness, fog, and even through thin walls or glass. With higher sensitivity, they can detect even the slightest movements, making them ideal for high-security applications. Furthermore, their detection area is adjustable, allowing fine-tuning to minimize false alarms.

Modern door automation systems often utilize a combination of PIR and microwave sensors to improve accuracy. PIR sensors ensure energy efficiency by detecting human presence, while microwave sensors provide precise motion detection, reducing false alarms and enhancing security. This hybrid approach optimizes performance, ensuring reliable and efficient door automation.

SERVO MOTOR (HD-1581HB)



Servo motors are preferred over other types of motors in applications requiring precision, controlled motion, and reliability. Here's why:

1. High Precision & Accuracy

Servo motors offer precise angular control (typically within 0.5° to 1° accuracy).

Ideal for robotics, CNC machines, automated systems, and model gearboxes where exact positioning is required.

2. Closed-Loop Control System

Uses feedback mechanisms (like encoders or potentiometers) to maintain accurate positioning.

Unlike DC motors, servos automatically correct any deviations in movement.

3. High Torque at Low Speeds

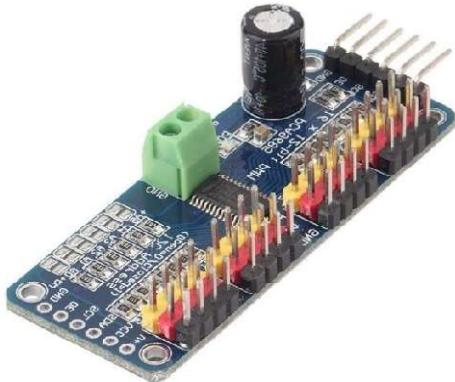
DC motors lose torque as speed decreases, but servos maintain high torque even at low RPM.

Useful for applications needing controlled force, like automated gear shifting or robotic arms.

IMAGE PROCESSING CAMERA



MOTOR DRIVER (PCA9685)



Why Use Arduino Over Other Microcontrollers for Door Mechanisms?

Arduino is a popular choice for automated door mechanisms due to its ease of use, flexibility, and large community support. Here's why it stands out compared to other microcontrollers like PIC, Raspberry Pi, or ESP8266:

1. Ease of Programming & Development

Uses Arduino IDE, which is beginner-friendly and has a simple syntax.

Has pre-built libraries for sensors like PIR, microwave, servo motors, etc.

Uses C/C++, which is easier to learn compared to assembly languages used in some microcontrollers.

2. Large Community & Support

Thousands of tutorials, forums, and open-source projects help in troubleshooting.

Extensive documentation simplifies integration with sensors and actuators.

3. Cost-Effectiveness

Affordable compared to many other microcontrollers.

Arduino Uno or Nano can handle basic door automation tasks at a low cost.

4. Wide Sensor & Module Compatibility

Supports PIR, microwave sensors, RFID, fingerprint scanners, and keypads.

Has multiple I/O pins to connect multiple devices easily.

5. Real-Time Processing & Quick Response

Fast processing speed for real-time motion detection.

Reliable for automatic doors that require quick opening/closing actions.

6. No Operating System Required

Unlike Raspberry Pi (which runs Linux), Arduino runs code directly.

Boots instantly and consumes less power.

7. Low Power Consumption

Uses low power, making it ideal for battery-operated or energy-efficient door systems.

When to Use Other Microcontrollers?

Raspberry Pi → If you need advanced features like AI-based facial recognition.

ESP8266 / ESP32 → If WiFi or IoT connectivity is required.

PIC/STM32 → If power efficiency and industrial-grade reliability are needed.

Contribution

Ayush PIR, Servo Motor

Aditya Microwave sensor, Camera

Harsh Mechanism, Motor Driver, designing

Shresth Material ordering, CV coding