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# Scarecrow with Solar Powered & Sound Sensing Mechanism

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*Abstract:* The flapping mechanism's function is to transform the motor's rotating motion into the reciprocating action of flapping wings. There are numerous ways to accomplish this; we will simply list a few of the most typical ones below. The mechanism must be compact and pretty straightforward. To ensure that the ornithopter flies straight, it must also have a somewhat symmetrical wing action.

A "four-bar linkage" is the foundation of the majority of mechanisms. The motor turns a crank shaft that rotates. The connecting rods push the wings up and down as the crank rotates.

Unfortunately, this method will result in asymmetric flapping when a second wing is introduced. At various angles, the two connecting rods emerge from the crank.

## INTRODUCTION

According to a survey, which labels it as an emerging concern in agriculture, birds, known to play a key role in fertilization, putting a mind to unpleasant bugs and rodents, could also be producing extraordinary lowering in agricultural yields by obliterating them.

According to the interim report of the Committee on Doubling Farmer's Income (DFI), bird species injure crops during the planting, seedling, and maturation stages, resulting in economic losses to the farming community.

The system provides the following advantages:

- Sound Detector to detect birds or Animal presence
- Human like hand motion to scare birds and animals
- Scaring Sound using speaker
- Solar powered system

The system is created utilizing a DC motor, a battery, solar panels, gears, linkage joints, a microphone for sound detection, a pole, and a model frame.

In a field, the scarecrow is supported by its metal pole. It may be installed anywhere outside since it doesn't need an external power source. Throughout the day, the solar panels of the system recharge the battery.

The microphone in the system continuously checks the ambient sound level. The controller monitors this signal and initiates an action when it detects a spike in the ambient sound level. Power is delivered to the DC motor, which rotates with the complete arm mechanism.

The linked arm mechanism is started in motion by the gear that is coupled to the motor shaft's rotation. The mechanism enables the arms to move vertically in a manner resembling that of a human to simulate a human presence. Additionally, the controller activates a speaker module to produce noise, scaring away nearby birds and animals. As a result, the technology offers a cutting-edge solar-powered scarecrow to defend fields against birds and other animals.

**Working Principle.**

According to the sunlight, a solar panel is positioned on a piece of land used for farming. The control unit, which changes the incoming AC power to DC power and steps it down using a transformer, is used to store the solar panel's energy in the battery. The sound creator, which is a component of the system, is then provided the supply voltage. It will generate a terrible noise that will frighten the bird. The solar bird fear will keep the birds from destroying the crops on the field. Therefore, it is quite helpful for all

landowners and farmers who grow food crops. When an object enters the sensor's detection range, the sensor detects the object and sends an electrical signal to the DC motor and sound hooter to activate the mechanism. Once the mechanism is activated, the system as a whole start.

**3. Component Used**

- Arduino Uno
- DC motor
- Solar Panels
- Gears
- Linkages and Arms
- Mic Module
- Regulator Circuitry
- Speaker Module
- Switches
- LED's
- PCB Board
- Resistors
- Capacitors
- Transistors
- Cables and Connectors
- Base Frame
- Supporting Frame

**3.1 Arduino UNO**

The Arduino UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

**3.2 DC Motor**

A DC motor or direct current motor is an electrical machine that transforms electrical energy into mechanical energy by creating a magnetic field that is powered by direct current. When a DC motor is powered, a magnetic field is created in its stator. The field attracts and repels magnets on the rotor; this causes the rotor to rotate. To keep the rotor continually rotating, the commutator that is attached to brushes connected to the power source supply current to the motors wire windings.

One of the reasons DC motors are preferred over other types of motors is their ability to precision control their speed, which is a necessity for industrial machinery. DC motors are able to immediately start, stop, and reverse an essential factor for controlling the operation of production equipment.

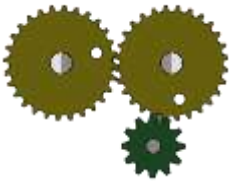
**3.3 Solar Panel**

A Solar panels (also known as "PV panels") is a device that converts light from the sun, which is composed of particles of energy called "photons", into electricity that can be used to power electrical loads.

Solar panels can be used for a wide variety of applications including remote power systems for cabins, telecommunications equipment, remote sensing, and of course for the production of electricity by residential and commercial solar electric systems.

### 3.4 Spur Gears

Spur gears are one of the most popular types of precision cylindrical gears. These gears feature a simple design of straight, parallel teeth positioned around the circumference of a cylinder body with a central bore that fits over a shaft. In many variants, the gear is machined with a hub which thickens the gear body around the bore without changing the gear face. The central bore can also be broached as to allow the spur gear to fit onto a spline or keyed shaft.
Spur gears are used in mechanical applications to increase or decrease the speed of a device or multiply torque by transmitting motion and power from one shaft to another through a series of mated gears.



### 3.5 Regulatory Circuits

A switching regulator circuit is generally more complicated to design than a linear regulator, and requires selecting external component values, tuning control loops for stability, and careful layout design.

Advantages of switching regulators include that they are highly efficient, have better thermal performance, and can support higher current and wider VIN / VOUT applications. They can achieve greater than 95% efficiency depending on the application requirements. Unlike linear regulators, a switching power supply system may require additional external components, such as inductors, capacitors, FETs, or feedback resistors. The HF920 is an example of a switching regulator that offers high reliability and efficient power regulation.

### 3.6 PCB Board

A standard PCB in its most basic form is a plastic board covered in fiberglass. Components are mounted on a non-conductive board and connected with small pathways, called traces.

Printed circuit boards are used in nearly all electronic products. Alternatives to PCBs include wire wrap and point- to-point construction, both once popular but now rarely used. PCBs require additional design effort to lay out the circuit, but manufacturing and assembly can be automated. Electronic design automation software is available to do much of the work of layout.

### 3.7 Resistor

A resistor is a passive two-terminal electrical component that implements electrical r element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads
for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

### 3.7 Capacitor

A capacitor is a device that stores electrical energy in an electric field by virtue of accumulating electric charges on two close surfaces insulated from each other. It is a passive electronic component with two terminals.

The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. The capacitor was originally known as the condenser, a term still encountered in a few compound names, such as the condenser microphone.

### 3.7 Transistor

A transistor is a semiconductor device used to amplify or switch electrical signals and power. The transistor is one of the basic building blocks of modern electronics. It is composed of semiconductor material, usually with at least three terminals for connection to an electronic circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Some transistors are packaged individually, but many more in miniature form are found embedded in integrated circuits.

### 3.8 Mic Module

The Microphone module can be used for sound/audio detection, it comes with the basic components for you to get started. Supplying power and it is good to be use. Do take note that this sensor module can only detect the present of sound/audio, but not to differentiate the sound's level. You can use it to detect sound and further determine whether human or animal is preset in a room, maybe for light activate with clap.

The is only digital output. Threshold can be adjusted with on board potentiometer for the digital output.

Simple usage as it is digital output, so you will know whether there is sound or not.

Comes with a M3 mounting hole for ease of attaching it to any object. On board it has microphone, high sensitivity and commonly being used for sound detection. The module comes with power LED and status LED as indicator.

It can be interface with any microcontroller with digital input such as

PIC, SK40C, SK28A, SKds40A, Arduino series for sound detection. Also, not to forget, interface with Relay module offer sound switch.

**Features:**

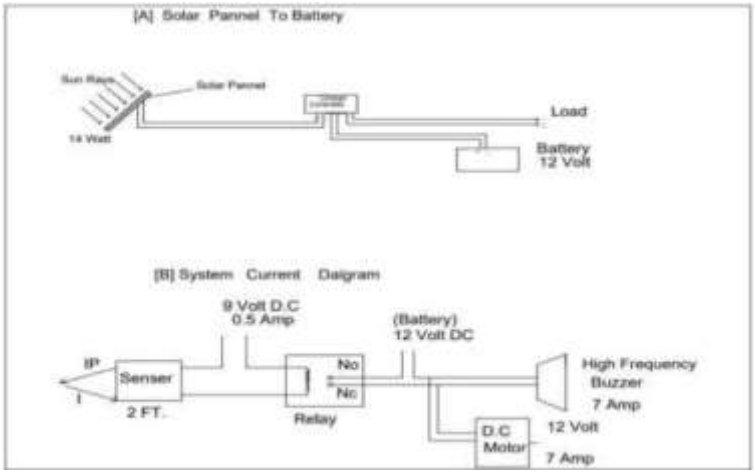
- Operating voltage: 1.3 to 12VDC
- PIN: VCC = 12V, GND = 0V, DO = digital output from module
- Sound detected, DO = LOW, on board LED is ON
- No Sound detected, DO = HIGH, on board LED is OFF
- Turn the on-board potentiometer clockwise will make module sensitive to sound
- Turn the on-board potentiometer counter clockwise make the module less sensitive to sound.

## IV BLOCK DIAGRAMS

**4.1 3D Model**

**4.2 Actual Model.**

## V CIRCUIT DIAGRAM




**5.1 Circuit Diagram.**

## VI DESIGN CALCULATIONS

### 6.1 Solar Panel

Determine the scarecrow's electricity needs using a solar panel. Assume it needs a 12V power source and can only use up to 2 amps.

Select a solar panel with the proper specifications for voltage and current. A 12V, 20W solar panel, for instance, would work.

Based on the quantity of sunshine and the battery's capacity, determine the solar panel's charging time. Assume that you receive six hours of direct sunshine each day. Calculating the charging time is as follows:

Charging Time = Solar Panel Power * Charging Efficiency / Battery Capacity

Considering a 12V, 20Ah battery with an 80% charging efficiency:
20Ah / 20W * 0.8 = 1.25 hours of charging.

### 6.2 Battery

Estimate the amount of battery power needed to keep the scarecrow lit at night. Consider the energy use of the scarecrow's parts, such as the sound detection device and any other electronics.

For instance, if you want the scarecrow to run for 10 hours without sunshine and it uses 0.5 amps per hour:

Battery capacity equals the necessary current times operating time, or 0.3A times 10 hours, or 3Ah.

Based on this capacity, select an appropriate battery, such as a 12V, 2Ah deep-cycle lead-acid Rechargeable battery.

### 6.3 Sound Sensing Mechanism

Choose a sound sensor module that can recognize the sound and cause the scarecrow to behave.

Find out how much electricity the sound sensor module needs. Assume it needs a 5V energy source and can only use 0.2 amps at a time.

### 6.4 Control Circuitry

Utilizing a microcontroller or comparable device, create a control circuit to process the output of the sound sensor and manage the scarecrow's behaviour.

Find out how much power the control circuitry needs. Assume it needs a 5V power source and can only use 0.5 amps at a time.

### 6.5 Optimization & Testing

Test the scarecrow in various scenarios to make sure it functions properly.

Improve the sound sensor's sensitivity and trigger thresholds as needed, and make required adjustments to the motor/actuator motions.

**6.6 Weight:**

a. Formula for calculation: Length x width x thickness x density
b. Weights of ribs (6 ribs total): 0.3 Kg.
c. Weights of top shelter: 4.0 Kg.
d. Weight of center rod: 2 Kg.
e. Weight of end links/ arms: 0.32 Kg.
f. Weight of steel plates: 1.5 Kg.
g. Solar Panel Weight: 0.5 Kg
**h. Total CAD Weight: 0.3+4.0+2+0.32+1.5+0.5 = 8.62 Kg.**

## VII CALIBRATION CODE

```
void callib_mode()
{
 i = 0;
 Serial.println("callib_mode enter");
 delay(2000);
 while (1)
 {
  if (callib_count == 0)
  {
   int value = analogRead(MIC);
   if (value > 200 && i < 100)
   {
    Serial.print(value);
    Serial.println(",");
    sample_values1[i] = value;
    i++;
   }
   if (i >= 100)
   {
    i = 0;
    callib_count = 1;
    Serial.println("callib_1 over");
    for(int j = 0;j<= 100;j++)
    {
     Serial.println(sample_values1[j]);
    }
   }
  }
  delay(1000);
  if (callib_count == 1)
  {
   int value = analogRead(MIC);
   if (value > 200 && i < 100)
   {
    Serial.print(value);
    Serial.println(",");
    sample_values2[i] = value;
    i++;
   }
   if (i >= 100)
   {
    i = 0;
    callib_count = 2;
    Serial.println("callib_2 over");
    for(int j = 0;j<= 100;j++)
    {
     Serial.println(sample_values2[j]);
    }
   }
  }
  delay(1000);
  if (callib_count == 2)
  {
   int value = analogRead(MIC);
   if (value > 200 && i < 100)
   {
    Serial.print(value);
    Serial.println(",");
    sample_values3[i] = value;
    i++;
   }
   if (i >= 100)
   {
    i = 0;
    callib_count = 3;
    Serial.println("callib_3 over");
    for(int j = 0;j<= 100;j++)
    {
     Serial.println(sample_values3[j]);
    }
   }
  }
  delay(1000);
  if(callib_count == 3)
  {
   callib_count = 0;
   callib_flag = 0;
   delay(2000);
   break;
  }
 }
}
```

## VII CONCLUSION

Since ancient times, scarecrows have been used in farming and elsewhere on houses and other buildings to deter birds from pecking at crops and causing roof damage. Birds must not find maize before scarecrows are in place, and beam height in relation to crop canopy is crucial. To establish the greatest coverage area, more research is required in wider fields. Growers have observed that using a laser scarecrow to guard entire fields reduces damage by around 10%.

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