

**CSE360**  
**(SPRING2023)**  
**LAB PROJECT REPORT**  
**SEC: 3 (Group:04)**

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# **Smart Security System by using Arduino**

## **Introduction:**

In today's society, establishing security is a must. Along with this security, another thing we now need to establish is protection. In light of this incident, we have devised an idea for a security and protection system with the help of Arduino. Our project provides a system where a servo motor will rotate continuously (here we are thinking of the servo as a machine) and if anything comes near the servo or if there is any smoke from a flame in the surroundings of the system, the servo will stop moving (considering the machine will stop so that it can ensure protection) and there will be a notification through Bluetooth in the mobile app of the owner or users. So, we have used an IR sensor, a smoke detector sensor, and a Bluetooth module for this project. Thus, this project provides a security system and protection in an environment that requires heavy work and won't be safe for all kinds of people.

## **Technology and tools:**

Our proposed automated system is very power efficient and requires basic electronic equipment. We will use a bluetooth transceiver module for remotely controlling the system, an IR sensor for detecting presence of any person, an MQ2 gas/smoke sensor for detecting any gas-leak or smoke from within the enclosed space and a buzzer for auditory warning. We will use a servo motor to represent hazardous machinery. To connect and coordinate all of these components, we will use an Arduino Uno board to interface all of them and it is more than powerful enough to handle all our intended operations.

## **Programming Language:**

We will use C as a language to write code for our system. Later it will be compiled as HEX file and this HEX code will be embedded in Arduino, to make the code executable in Arduino.

## **Working mechanism of Sensors:**

**IR Sensor:** For our setup we will use an IR transceiver- an active sensor. An infrared emitter transmits a signal that is received by an IR receiver in the same module. If the received signal is interrupted, we will be able to identify if a person is near the machinery. In reality these sensors would surround the hazardous machines, but we are using just one for our demonstration.

**Smoke Sensor:** We will use a versatile MQ2 smoke sensor in our project to detect smoke or gas leaks in the house. It can detect LPG, smoke, alcohol, methane, hydrogen, propane, and carbon monoxide concentrations in the air. The MQ2 sensor contains heating and sensing elements, usually made of tin dioxide ( $\text{SnO}_2$ ) or similar materials. The sensing element is heated by the heating element, and when smoke particles come into contact with the heated sensing element, the sensing element's electrical conductivity changes. The sensor's circuitry detects the change in electrical conductivity. Finally, it will cause an alarm or other type of alert to indicate the presence of smoke.

**Bluetooth Module:** To enable wireless communication and control we will use a Bluetooth module. It will provide remote control and ease of access. There might be situations where we may want

to override the decisions wirelessly. To communicate, we just have to type in the Bluetooth terminal application of the smartphone. If the IR sensor detects any object the characters will be sent wirelessly to Bluetooth module HC-05. HC-05 will automatically transmit it serially to the device, which will appear on the terminal. It will give the notifications. It will work in the same way when there will be no object. In the case of smoke detection, we will get the notification by bluetooth module.

**Arduino Uno :** We power the Arduino board by using its onboard USB connector . The USB connector provides a regulated 5V line to power the board's electronics. Arduino has 14 digital pins & 6 analog pins. Among Arduinos 14 digital pins we connect our IR sensor with pin number 06 & LED with pin number 08 . We connect our smoke sensor with the A0 .

**Servo Motor :** A servo motor is an electrical device which can push or rotate an object with great precision. In our system instead of using a big machine we use a servo motor to represent this . Here , if any obstacle can be detected by the IR sensor or any smoke detected by the MQ-2 smoke sensor the servo motor will stop its rotation . It indicates that if any obstacle or danger comes the machine will stop its work.

## PIN Diagram:

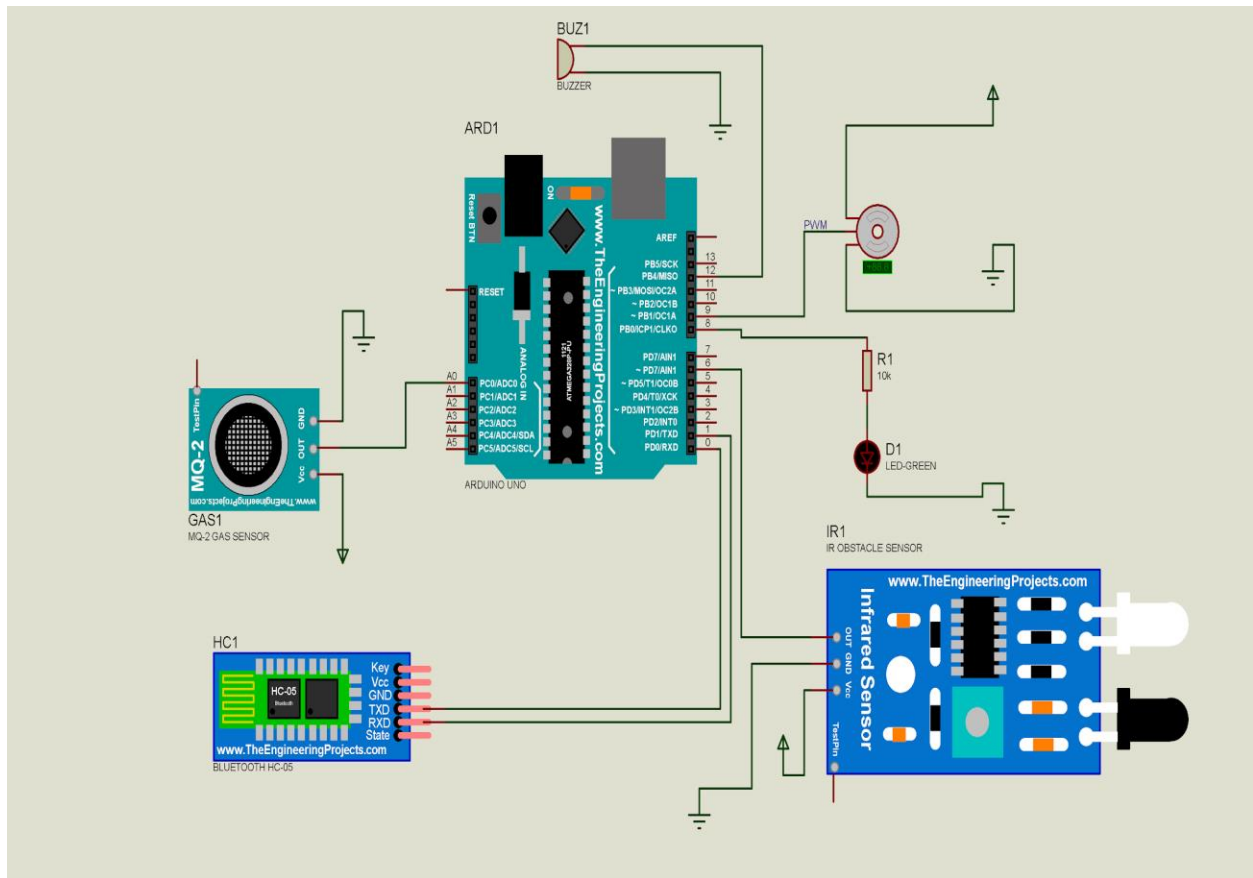


Figure1: Pin diagram & connectivity of our project.

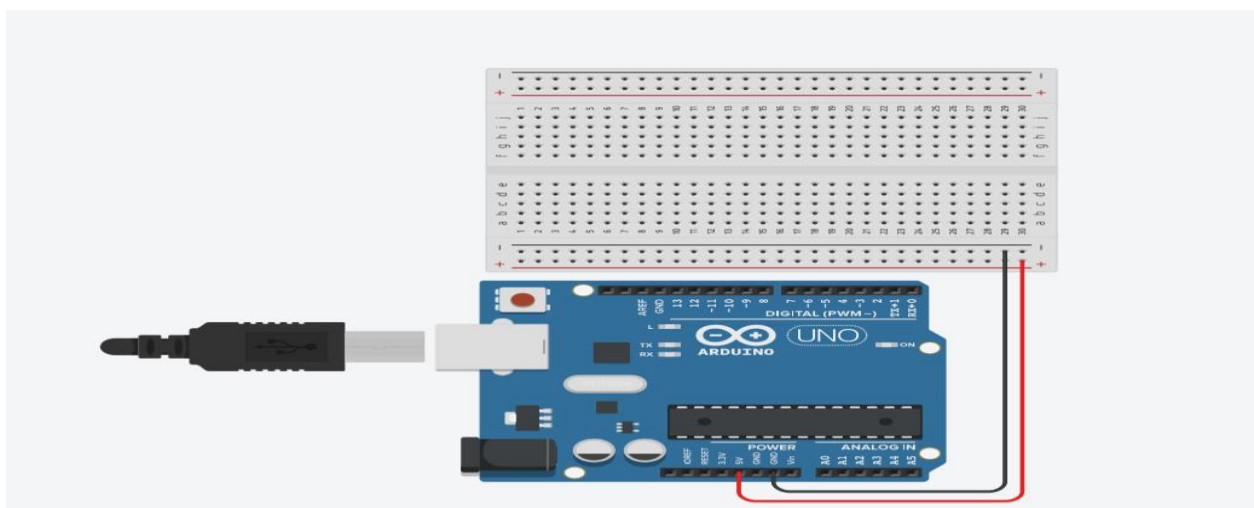


Figure2: The way arduino uno is connected to the breadboard.

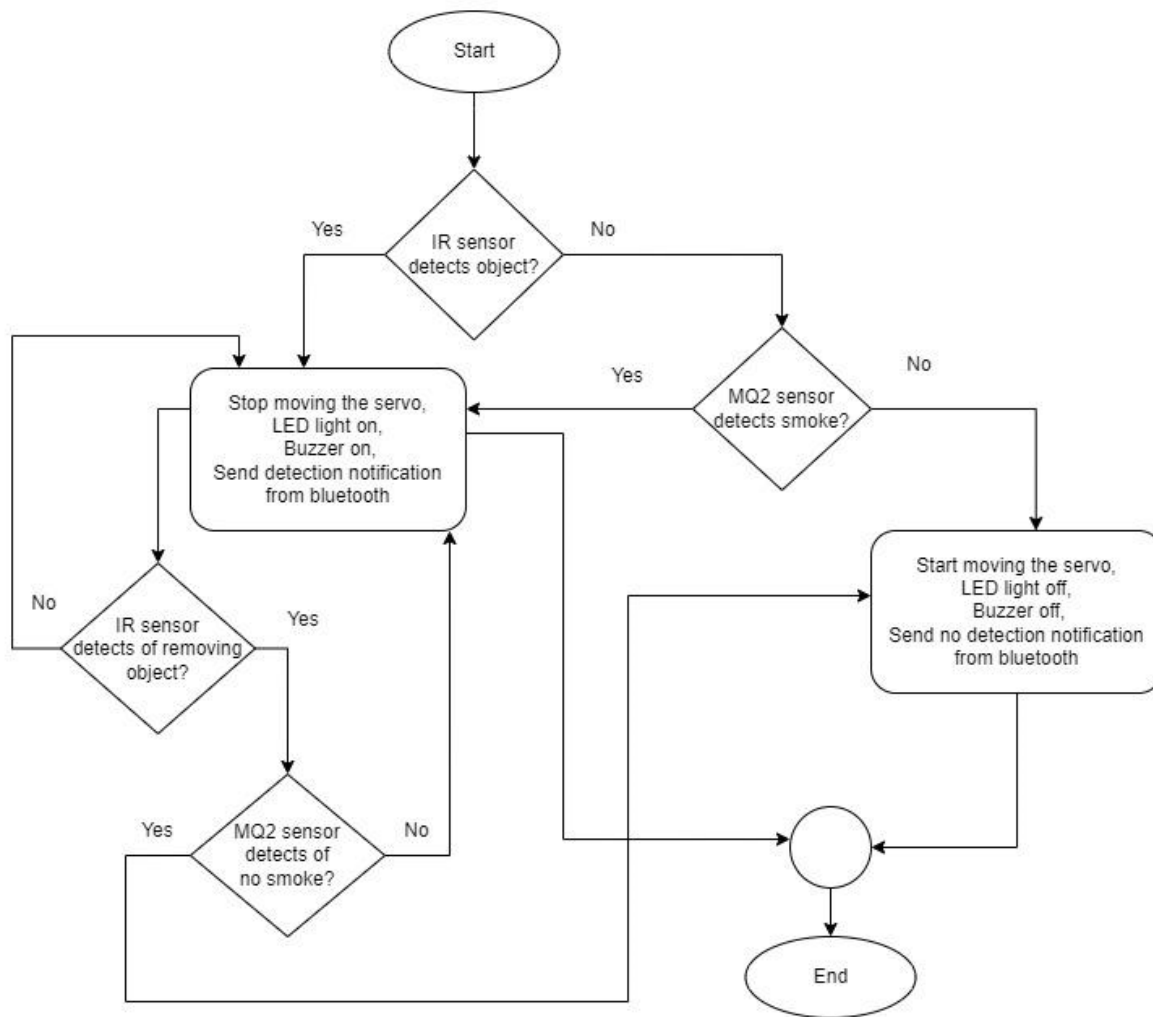
## Connectivity & general dataflow:

Here, we have used a servo motor as a symbol of a dangerous heavy machine that may cause a life-threatening accident while being near humans (especially children or disabled people) or a smoky environment. We have used Arduino Uno as the microcontroller to control this system. The pin connections of this project are-

1. **Arduino Uno:** We attached the 5v and GND of the Arduino Uno to the (+) and (-) of a breadboard to provide positive 5v (VCC) and 0v (GND) respectively to the other components. The Arduino gets power from the USB cable connected to our pc or laptop directly.
2. **MQ-2 Smoke sensor:** The VCC and GND pins of the MQ-2 smoke sensor are linked to the (+) and (-) pins on the breadboard while the analog output (A0) pin is connected to the A0 pin of the Arduino.
3. **Active IR sensor:** We connected the VCC and the GND pins of the IR sensor to the positive and negative connection of the breadboard. The IR output pin is linked to the PIN 6 of the Arduino.
4. **HC-05 Bluetooth module:** We joined the RXD and TXD pins of the Bluetooth module to the TX and RX pins of the Arduino respectively alongside connecting the VCC and GND pins to the positive and negative rows of the breadboard respectively.
5. **Servo motor:** The red wire of the servo is connected to the VCC (5v) and the brown wire of the servo is connected to the GND (ground). Besides, the orange PWM wire of the servo is connected to the PIN 9 of the microcontroller.

6. **LED:** We attached the negative side of the LED to the GND of the breadboard and the positive side to a 10k resistor serially. Then joined the other side of the resistor with the PIN 8 of the Arduino Uno.
7. **Buzzer:** The positive side of the Buzzer is connected to the PIN 12 of the Arduino while the negative side is connected to the ground.

We have used jumper cables to build all the linkages. Whenever the IR sensor detects any obstacle or the smoke sensor detects any smoke or gas, the servo gets turned off alongside turning on the LED and the Buzzer while the Bluetooth module sends a notification to the owner of this dangerous situation.



**Figure:** Project flow chart

## Project Idea and Workflow:

Basically, we got our project idea from [1], where they worked with a servo motor, LED, and IR sensor. Their project was to rotate the servo by 10 degrees and turn on the LED if the IR sensor detects something; if there is no object, the servo will rotate 150 degrees and the LED will be turned off. Again, in [2], they worked with an MQ2 sensor, buzzer, and servo motor. There they worked to detect gas leakage and control the servo.



So, in our project, we first established a system where the servo will run continuously if there is no object or smoke detected in the system, which will be detected by the IR sensor and the MQ2 sensor. And when the system detects any object or smoke, the servo will stop moving, the LED will be turned on, and the buzzer will sound, which will act as a warning or alarm. Also, we have connected a Bluetooth module HC-05 which will give us a notification like when an object is detected, it will show the text “An object is detected!” in the phone (android) application (the application we have used here is Serial Bluetooth Terminal), and when the object is removed, it will show “Nothing is detected!”. Similarly, it will show the same kind of notification for smoke detection.

### **Estimated cost analysis:**

The components we will be using are 1 Arduino uno, 1 MQ-2 Smoke sensor , 1 HC-05 bluetooth module , 1 active IR obstacle sensor, 1 servo motor, LED(5X), Buzzer .

#### **Price list:**

Arduino Uno - 790 tk

MQ-2 Smoke sensor - 150 tk

HC-05 bluetooth module - 342 tk

Active IR obstacle sensor - 93.80 tk

Servo motor - 150.98 tk

LED - 1.96 tk

Buzzer - 20 tk

These are the estimated prices for the above components we used in this project. Although the price might vary, this system will not cost more than 1550 tk. So, we can say that this system can be more user friendly according to the cost estimation than other security systems available in the market.

## **Conclusion:**

This automated security system is still not widely used. Still, in our project, we have built a system where security and protection are both established. These components, like sensors, Bluetooth, and others, are part of our daily lives. Moreover, this system will ensure protection for children as well as prevent theft.

Furthermore, in the future, the system can be added with WiFi or an application with data so that the owner will be able to get alerts or notifications on that. Also, a real machine can be used in the future where we have used the servo motor.

## **Reference:**

[1]<https://arduinointro.com/projects/making-servo-motors-react-to-sensors>

[2]<https://quartzcomponents.com/blogs/electronics-projects/lpg-gas-leakage-detector-using-mq2-sensor-and-controller-using-sg90-servo-and-arduino>