CSE211

Introduction to Embedded Systems

Project

HAZARD DETECTION SYSTEM

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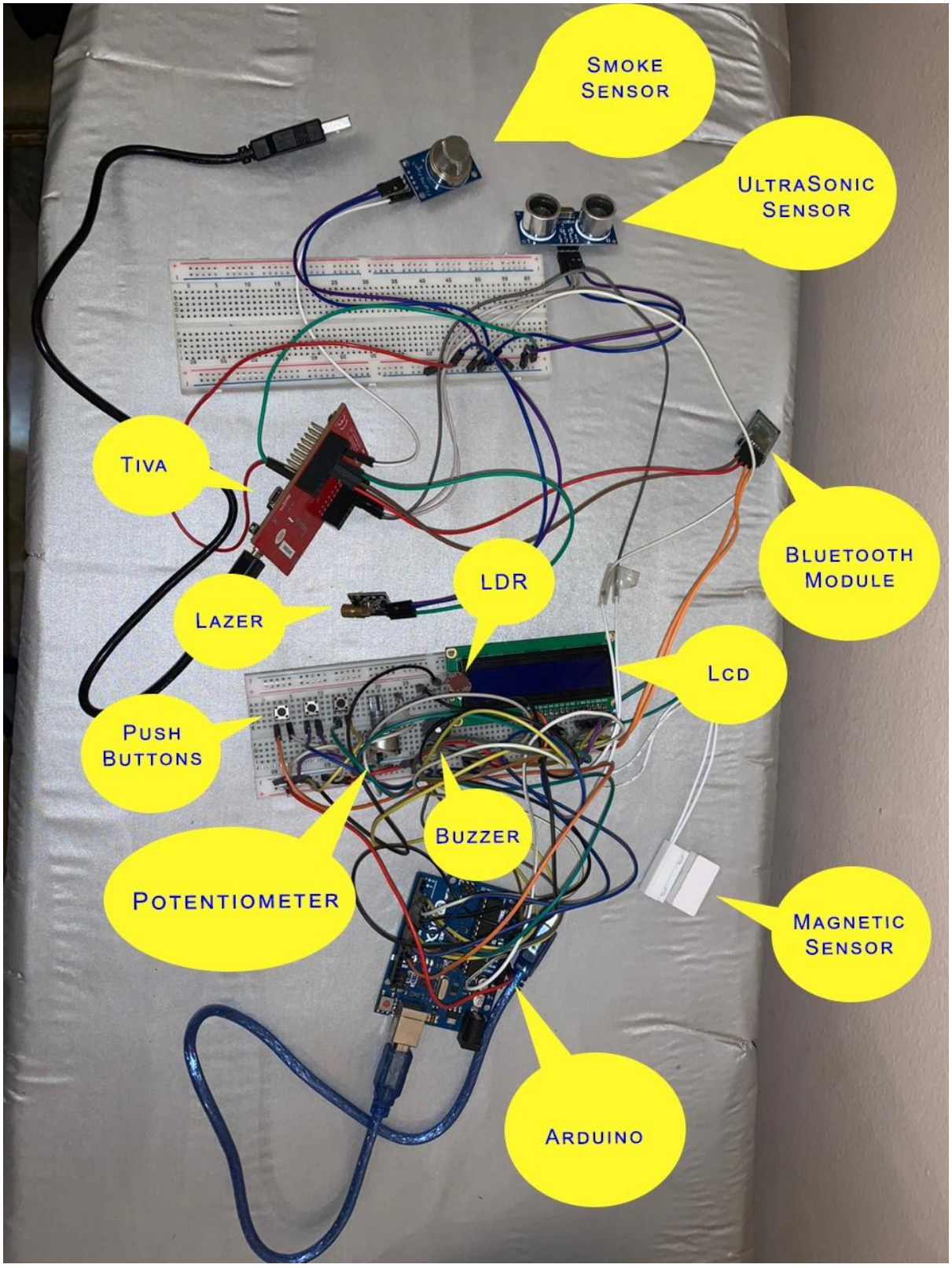

Figure 1: System Layout

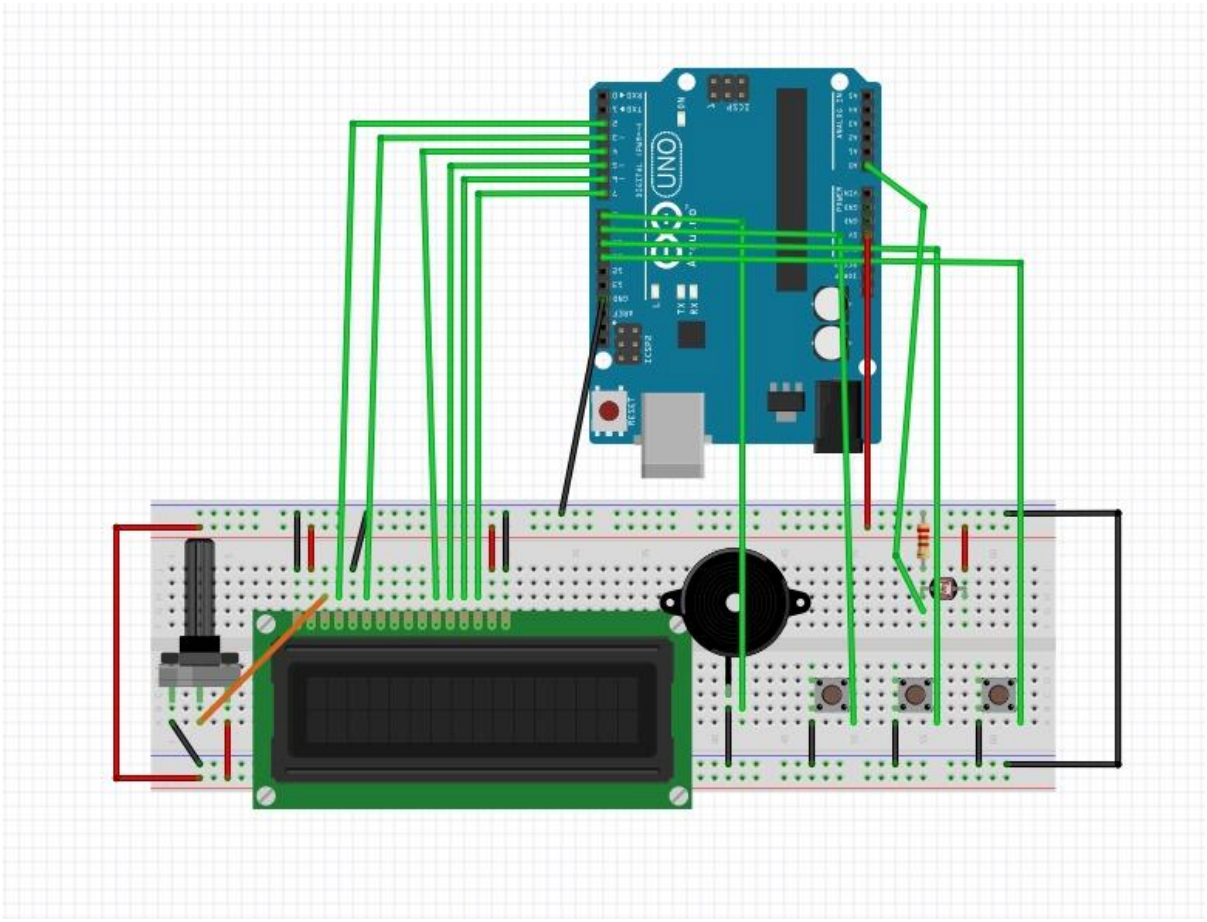

Figure 2:Arduino Layout

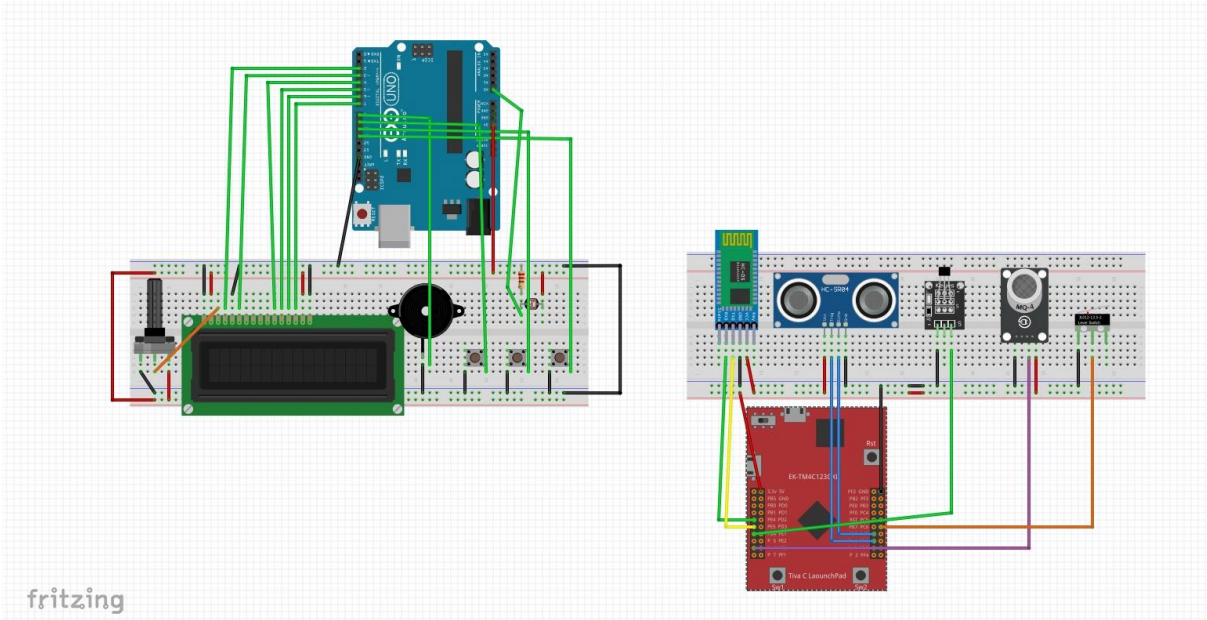

Figure 3:Overall Layout

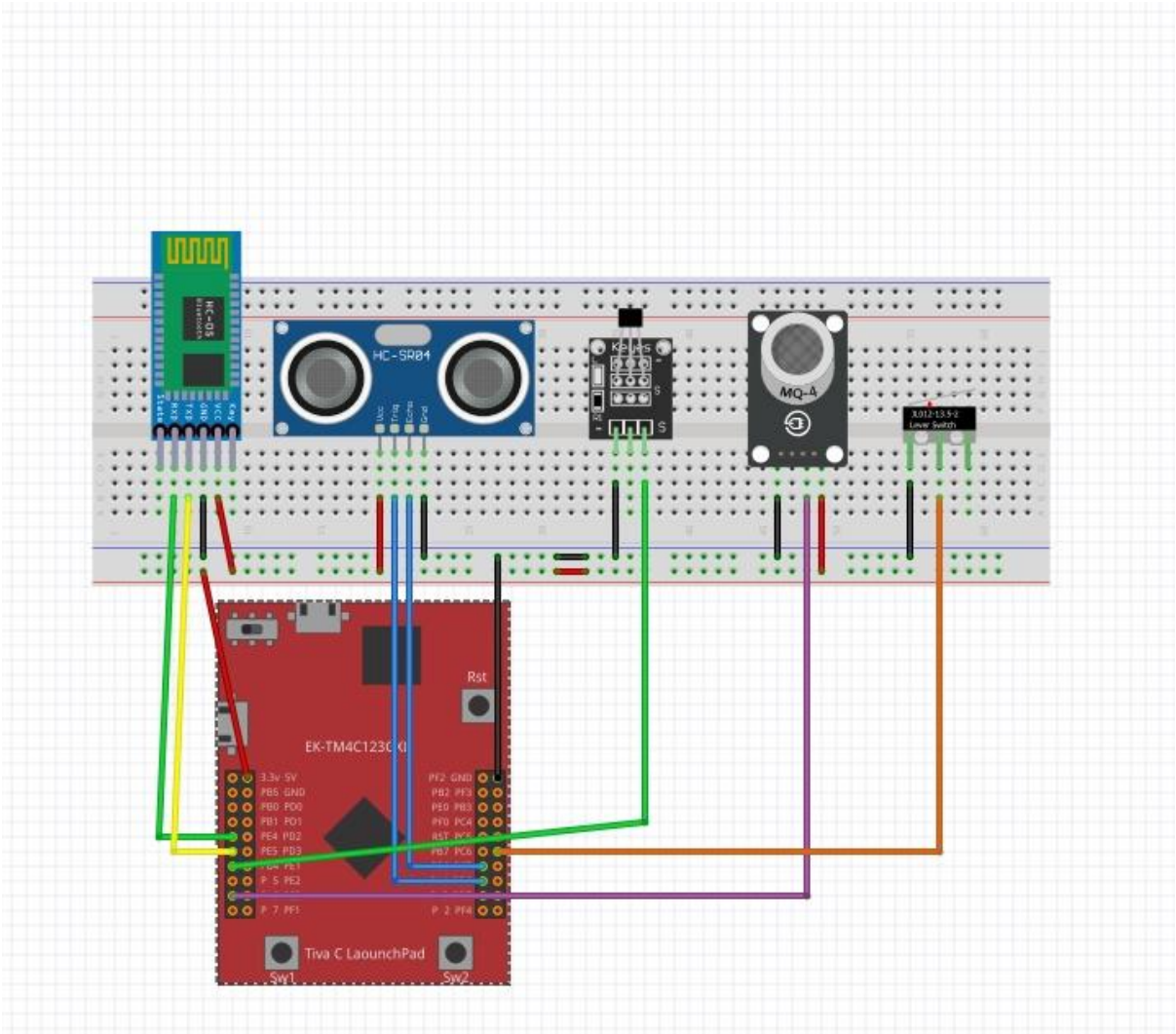

Figure 4:Tiva Layout

List of Components

- Smoke Sensor :
  - VCC
  - Ground
  - Ao (Analogue Output): The Aout pin provides an analog voltage signal proportional to the concentration of the detected gas. The voltage level varies depending on the concentration of the gas in the air. Typically, you would use an analog-to-digital converter (ADC) to convert this analog voltage into a digital value that can be processed by a microcontroller.
  - Do (digital output) : The Dout pin provides a digital signal that indicates whether the gas concentration has crossed a predefined threshold. It is a digital signal that is either high (logic level 1) or low (logic level 0). The threshold is usually set by a potentiometer on the sensor module or is pre-defined by the manufacturer. When the gas concentration exceeds the set threshold, the Dout pin goes high, signaling the presence of the gas (not used in our system).
- Ultrasonic Sensor:
  - VCC
  - Ground
  - Echo: The Echo pin is used to measure the time it takes for the ultrasonic pulse to travel to the target object and back.
    After sending the ultrasonic pulse, the sensor listens for the echo. When the echo is detected, the Echo pin goes high (or changes its state), indicating the end of the pulse travel time.
  - Trigger: The Trigger pin is used to initiate the measurement.
    When a short pulse (typically around 10 microseconds) is applied to the Trigger pin, the ultrasonic sensor sends out a brief ultrasonic pulse.
- Magnetic Sensor:
  - Signal: Connected to the pin on tiva (to read 1 or 0)
  - Ground
- Laser Module:
  - Signal: Connected to the pin on tiva (to write 1 or 0)
  - VCC
  - Ground
- Bluetooth Module:
  - VCC : takes it's VCC from Arduino because it needs 5 volts to operate.
  - Ground
  - TX: This pin is used for serial data reception. Connected to the RX (transmit) pin of the tiva with which the HC-05 is communicating.
  - RX: This pin is used for serial data transmission. Connected to the TX (receive) pin of the tiva with which the HC-05 is communicating.
- LCD (Liquid Crystal Display):
  - VCC
  - Ground
  - VEE : connect to a potentiometer for contrast adjustment
  - RS : connect to a digital pin on tiva

    - RW : Connect to Ground
    - E (enable): Connect to a digital pin on the tiva
    - D0-D7 : connected to pins on the Arduino
- Buzzer:
    - Ground
    - Arduino Pin
- Push Buttons:
    - Ground
    - Arduino pin
- LDR :
    - VCC
    - Analogue pin (Arduino)
    - Ground

Circuit Wiring

Tiva Wiring

Function	Pin(s)
Ultrasonic trigger	PA4
Ultrasonic echo	PB6
Smoke sensor Analogue pin Ao	PE3
Magnetic Sensor	PB6
Laser Module	PB4
UART5 RX	PE4
UART5 TX	PE5

Arduino Wiring

Function	Pin(s)
LCD	2,3,4,5,6,7
Buzzer	8
Start Push Button	9
Stop Push button	10
Mute push button	11
LDR	Analogue pin A0

Mobile Application

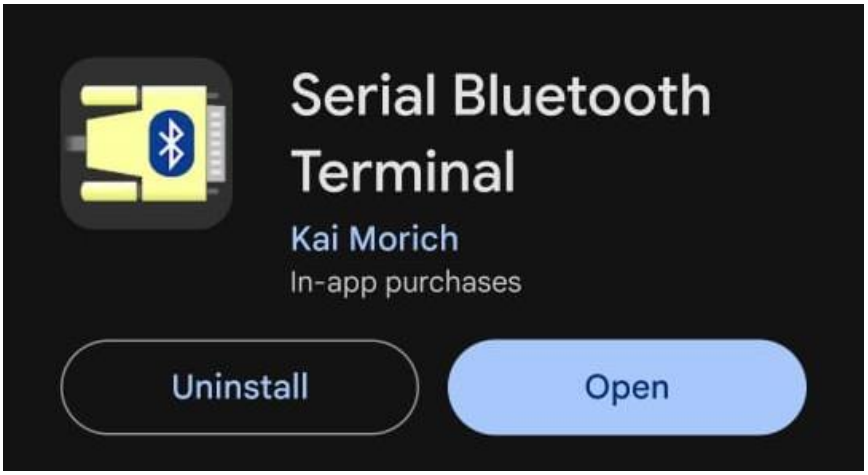

Figure 5:Application

Serial Bluetooth terminal used as the application to receive any hazard detected in the system. The same message printed on the LCD is sent to the application and printed.

Intrusion Detection:

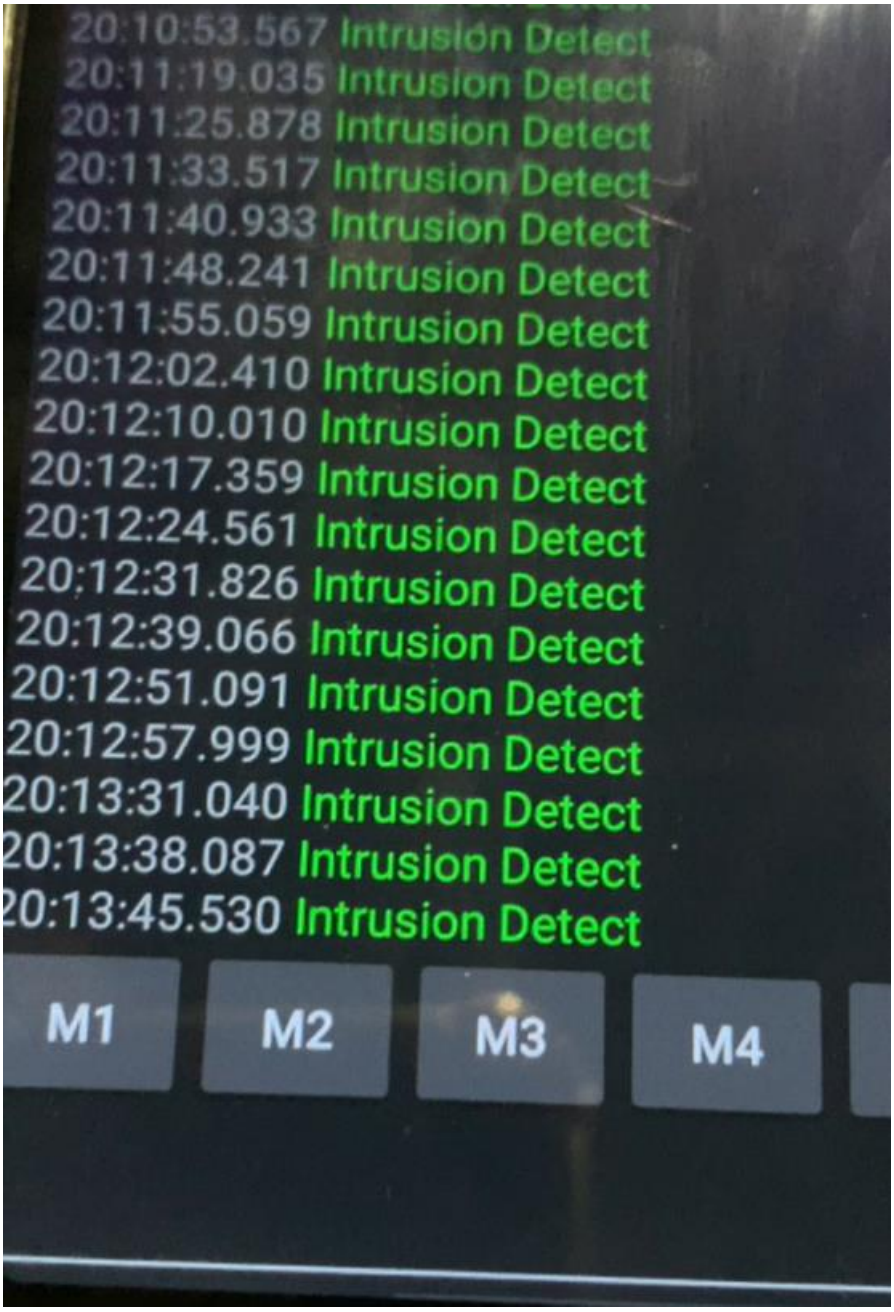

Figure 6:Intrusion Example

Smoke Detection:

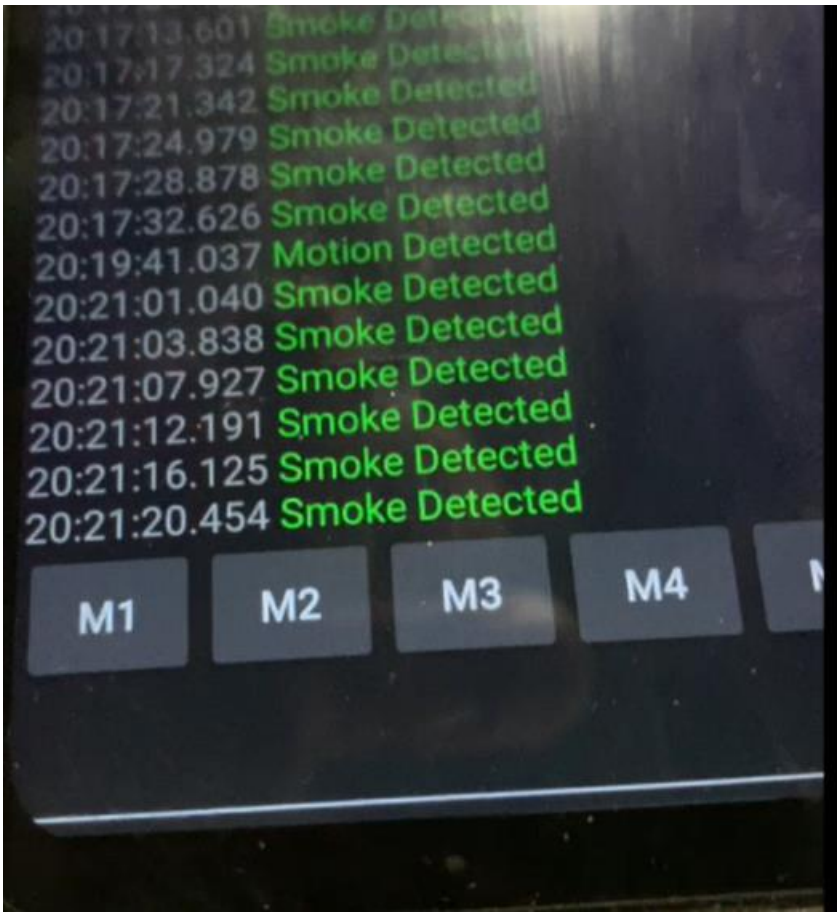

Figure 7:Smoke Example

Motion Detection:

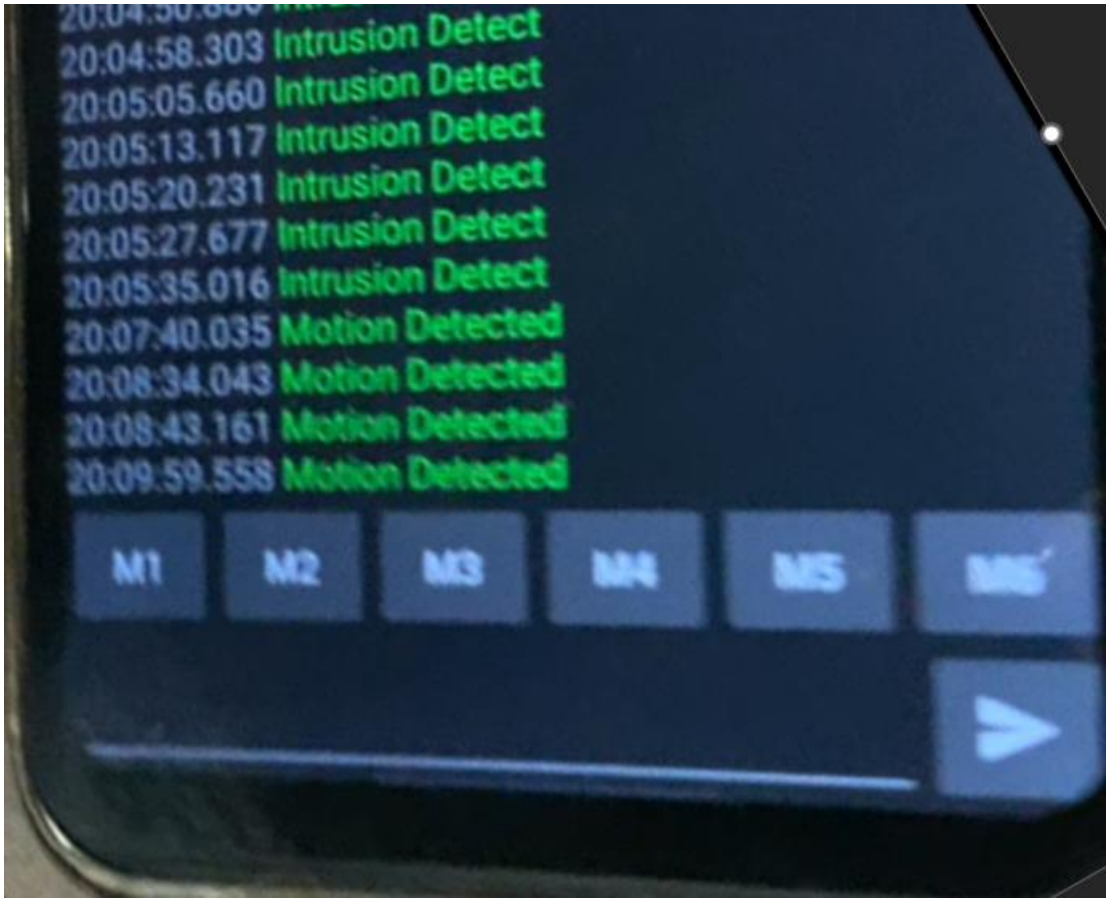

Figure 8:Motion Example

Flow Chart

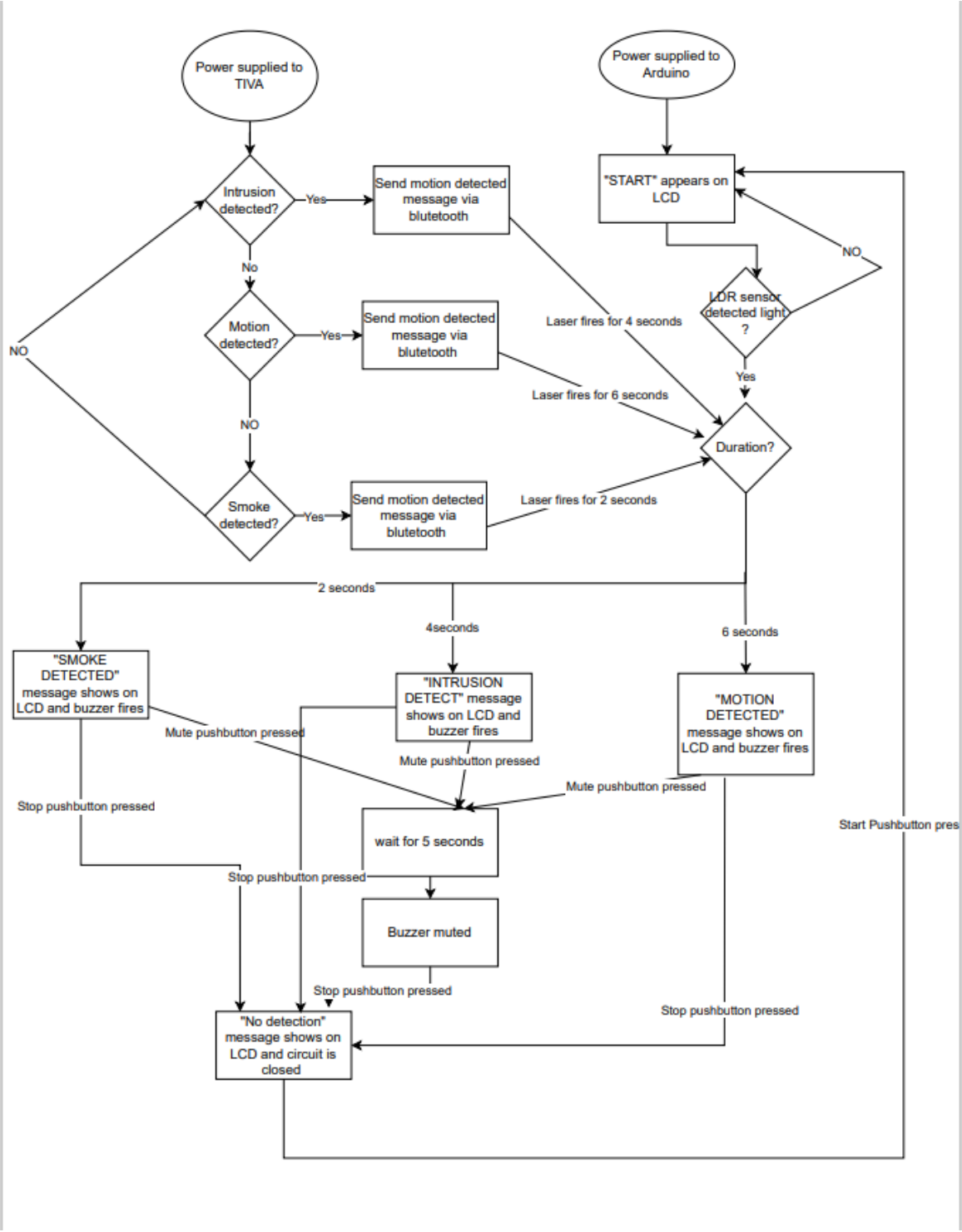

Figure 9:Flow Chart

Problems Faced

Problem: Ultrasonic sensor was not detecting any motion.

Fix: appeared to be a jumper problem. By changing jumpers, motion detected accurately.

Problem: LDR was not detecting light when changing system illumination environment.

Fix: read LDR value without laser. And change threshold in code upon this value.

Problem: Smoke Sensor was not detecting smoke.

Fix: get the reading of the smoke sensor without smoke, then adjust threshold of detection upon this value.