DALHOUSIE UNIVERSITY
FACULTY OF ENGINEERING

Austin Axworthy
Ian Robert
Joe Mahon

Peter Bragg

Department of Electrical and Computer Engineering

Carbon Monoxide Evacuator

Introduction

- Initially tasked with designing and creating a device which can detect the presence of Carbon Monoxide within a garage, alert people within the space, and exhaust the deadly gas from the space.
- Due to costs with creating such a complex system, a device which can detect carbon monoxide and power a receptacle was created instead.

Project Scope

- Device is powered by a household receptacle.
- Device can detect and monitor CO in garages up to 600 sq. Ft.
- Device triggers when a concentration of 20 ppm of CO has been detected.
- Device controlled by Arduino UNO R3.
- Installed semi-flush or surface mounted on garage wall.

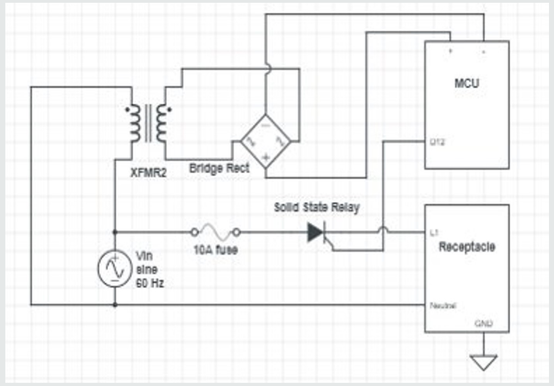
Design Process

- The device was broken down into 5 sub systems
  - MQ-7 Carbon Monoxide Sensor
  - Receptacle controlled via SSR
  - CO and Power on LED visual indication
  - Arduino uno C/C++ Software Integration
  - Device Power and Enclosure

- Each subsystem was designed and tested separately.
- An accurate CO measurement device was used to ensure our CO sensor was providing us with accurate readings.
- Circuits were first tested on breadboards, before being soldered onto blank protoboards to perform more reliable while keeping the project cost within our budget.
- Once all subsystems were confirmed to be working as intended, they were integrated together and tested.

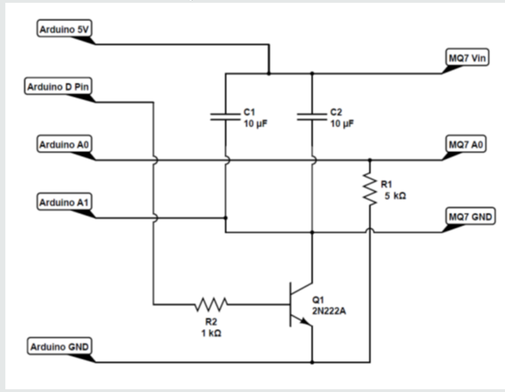
Details of Design

Receptacle control circuit schematic



Once a CO PPM of 20 or greater has been detected, the MCU energizes the SSR relay, which supplies the receptacle with power, allowing user added devices to alert or remove the gas.

MQ-7 Gas Sensor



The MCU provides sensor with 5V for 60 seconds, and then reads analog output for 90 seconds while providing the sensor with 1.4V.

Sensor readings

CO Detected

CO measurements update when the heating phase starts (denoted by red plot). If an ADC value is measured greater than 180 CO ppm is detected and calculated

Fully Assembled Device

- Enclosure dimensions - 6" wide by 6" high by 4" deep
- Removeable cover
- Device either surface or semi-flush mounted by 4 exterior brackets
- MCU and protoboard are stack mounted on repurposed wall plate
- Receptacle, MQ-7 sensor, and LED indicators mounted on cover
- Receptacle housed in utility device box

Conclusion/Recommendations

- Our team's final device can detect CO concentrations accurately and reliably.
- The modular design allows for the easy addition of safety devices such as audible alarms, visual alarms, garage door openers etc.
- Future builds should use PCB's to minimize the size of the circuitry, along with removing some noise from the circuit, which will provide a more accurate CO reading. This would also allow for mass production of the system at a reduced cost.
- The Arduino UNO could be replaced with an Arduino NANO. This would allow for a smaller device enclosure.

References

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