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Automobile Security System Using Arduino and MQ3 Sensor

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***Abstract*: Road accident are undoubtedly the most frequent and, overall, the cause of the most damage. The reason for this is the extremely dense road traffic and the relatively great freedom of movement given to drivers. Drunken driving is one of the leading causes of road fatalities. Effective monitoring of drunken drivers is a challenge to the policemen and road safety officers. This limited ability of law enforcement agents undermines every manual effort aimed at curbing drink-driving. This project aims to provide a two level security on vehicle in minimal cost.**

***Keywords*: Ardunio, Servo motor, MQ3 Sensor, LCD 16x2.**

1. Introduction

In this project we design an Automobile Security System aims at provide a two level security on any vehicle, that the user wishes to implement. It includes a MQ-3 Sensor for alcohol detection in the drivers breathe, since drunken driving is a major cause of accidents in our roads today.

Our system, integrates the following hardware components in the design: LCD, MQ-3 alcohol sensor, 4x4 Keypad, DC motor and a LED integrated to Atmega328 microcontroller. The proposed design system is designed and simulated using Proteus VSM simulator. The software code to be burnt into the Arduino board was written in Arduino IDE sketch. This project uses an Arduino kit that consists of ATMega 328 which is one of the most popular microcontrollers that consists of 14 digital pins and 6 analog general purpose pins, EEPROM of capacity 1KB and a ram of 2KB.

2. Components

The following components are used which are provided in detailed for designing this automobile security system:

A. Arduino Uno

Arduino is an open source physical computing platform based on a simple I/O board and a development environment that implements the Processing/Wiring Language. The board can be used to make stand-alone interactive objects or can be connected to software on the computer. The open-source IDE can be downloaded for free from arduino.cc.

There are total of 20 pins (0-19) out of which 06 are analog inputs which can also be used as general purpose pins, a ceramic resonator of frequency 16MHz, an USB connection, a power jack and a reset button. It is a fully functional multipurpose microcontroller.

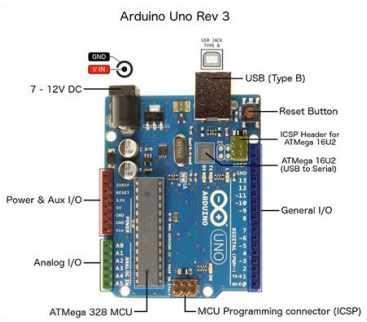

Fig. 1. Arduino UNO

Summary on Specifications:
Microcontroller: ATMega 328
Clock Speed: 16MHz
Input Voltage: 6-20V
Operating Voltage: 5V

Table 1
Pin Description

Pin Category	Pin Name
Power	Vin, 3.3V, 5V, GND
Reset	Reset
Analog Pins	A0-A5
Input/output Pins	Digital Pins 0-13
Serial	0(Rx), 1(Tx)
PWM	3,5,6,9,11(8bit)
Inbuilt LED	13

B. MQ-3 Alcohol Sensor Unit

This is a simple-to-use gas leakage detection (in home and industry) suitable for detecting alcohol, benzene, CH4, Hexane and LPG. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensor output is an analog resistance along with a digital output. The drive circuit is very simple and a power coil with 5V, add a load resistance and connect the output to the microcontroller.

The sensor used for alcohol sensing belongs to a gas detecting class of sensor namely MQ-3(Fig), a low cost semiconductor sensor which can detect the presence of alcohol gases concentration from 0.05mg/L to 10mg/L. The sensitive

material used being: SnO_2, whose conductivity is lower in clean air. It's conductivity increases as the concentration of alcohol gases increases. It is high sensitive to alcohol and good resistance to disturbance due to smoke, vapor and gasoline. Sensors can be used in breathalyzer.

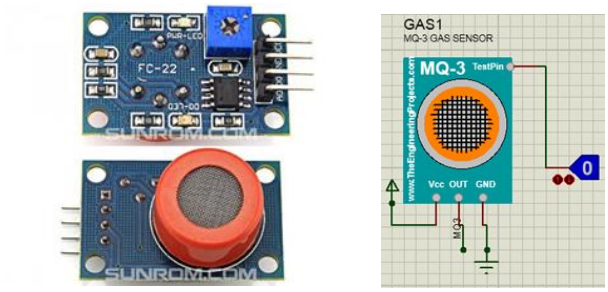

Fig. 2. MQ-3 Sensor

C. LCD

An LCD is an electronics display module which uses liquid crystal to produce a visible image. We use a 16x2 type basic module for displaying the inputted keys and also to indicate alcohol presence. The backlight in the LCD module uses a 5V for its working. It has two types of registers namely command and data. RS pin holds whether the operation chosen is command or data. Command instructions includes: clearing, resetting, cursor position etc. For RS=1, data registers are used.

The display units used include a LCD module of 16 pins, displays alphanumeric and symbols. (Fig. 3). It consist of 8 data line, 3 control lines, 2 power lines, 1 contrast line and 2 pins for backlight(LED). Data lines and control lines are controlled by the microcontroller. They use the library file <LiquidCrystal.h> in Arduino IDE. Power Supply: +5V, Output Voltage: 0.4 -2.4V (For simulation purpose we used: LM041L available in the inbuilt library of Proteus).

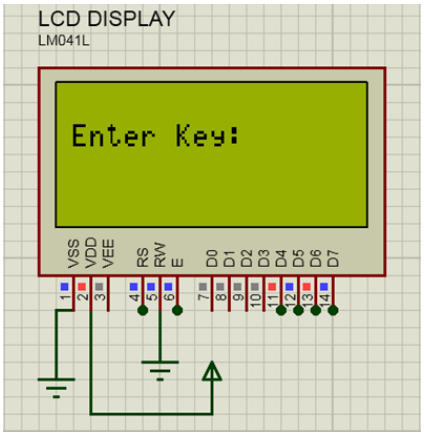

Fig. 3. LM041L 16x4 LCD Display

D. Membrane Keyboard

The slim, 16-button (4x4) keypad provides a useful human interface component for the project. Convenient adhesive backing provides a simple way to mount the keypad in a variety of application. Provide easy communication with the microcontroller. They are accessed and used in the project by addressing a keypad library file during its program code.

In our system we use a 4x4 matrix membrane keypad (Fig 4). This 16 button keypad provides user interface component for Arduino project. They are programmed using the library <keypad.h>. Maximum Operating Range:24Vdc, 30mA Insulation Resistance:100MΩ (For Simulation we use VSM DLL Model Keypad).

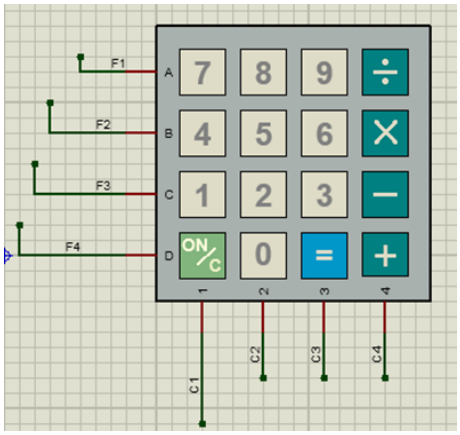

Fig. 4. 4X4 Matrix Keypad

E. Indicating Units

We have used 2 indicating units:

1. *LED:* The LED used in the project is to represent the vehicle in-built system working on authorized entry of key (password). LED (FW Voltage:1.8-3.3 V) used in simulation to represent In-built car modules like entertainment system, AC , power adapter, lamps etc. An authentic owner of the vehicle feeding the correct key for the safety system can use the in-built facility available in the automobile. It is to be noted that, a correct key wouldn't give the user to start the automobile engine.
2. *DC Motor:* The motor here, is a simulation element as an engine motor, and is ON when no alcohol presence is detected. It is used to demonstrate the concept of engine locking mechanism in the system. Connected across Arduino Pin and ground. The motor starts only when not drunk authentic drivers enter the correct key and negative indication on breathe analyzer (MQ-3 Sensor output low).

3. Implementation- connection wiring spot diagram and circuit diagram

The following table shows the connection wiring spot diagram of our circuit. The entire circuit diagram can be tabulated as shown below:

Keyboard Pins: A-A0, B-A1, C-A2, D-A3; C1-1, C2-2, C3-3, C4-4. LCD Pins: VSS (1)-GND, VDD (2)-Power, VEE (3)-x, RS(4)- D12,RW (5)-GND,E(6)-D_{11},(7,8,9)-x, D3 (10)-D_4 , D4(11)-D_5, D5(12)-D_6, D6(13)- D_7, D7(14)-x. LED Pin-D_{13}

MQ3 Sensor Pins: V_{ss} -Power, OUT-D_8

We use the test pin in the MQ3 Sensor to test for manifestation an alcoholic and non-alcoholic user.

The following figure shows the schematic diagram for the project. The components used in design and connections of the project are as follows:

- Arduino Uno
- MQ3 Sensor
- Liquid Crystal Display (LCD LM041L 16x4)
- 4x4Membrane Keypad
- Servo Motor
- LED

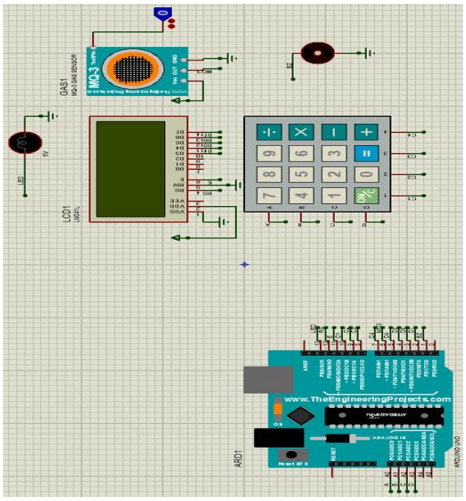

Fig. 5. Circuit diagram of the project in proteus

4. Working of the circuit

The below given flowchart provides a brief idea as to how the project working is. Initially the power of the system is assumed to be ON, the user enter his/her password into the keypad membrane. For any incorrect entry of password, the user is redirected back into the home screen where in multiple wrong attempts will have a warning flag on. For an authentic entry the user is allowed to use the in-vehicle info/entertainment system. After a finite interval the user is requested to check for his/her alcohol level by blowing into the sensor. For a negative test the car engine can be started, while for any levels of alcohol in or near the drivers/users body may alert the system and won't allow for any further actions.

- Step 1: Power on the system.
- Step 2: User Enters the Key.
- Step 3: If Key is Incorrect
- Step 3.1: Go to Step 2.
- Step 4: Else, In-built car system functional
- Step 5: After 5 sec breathe into the MQ-3 sensor.
- Step 6: If Alcohol is Detected.
- Step 6.1: Car engine won't start, Go to Step 1.
- Step 7: Else Car Engine Running
- Step 8: End/Go to Step 1.

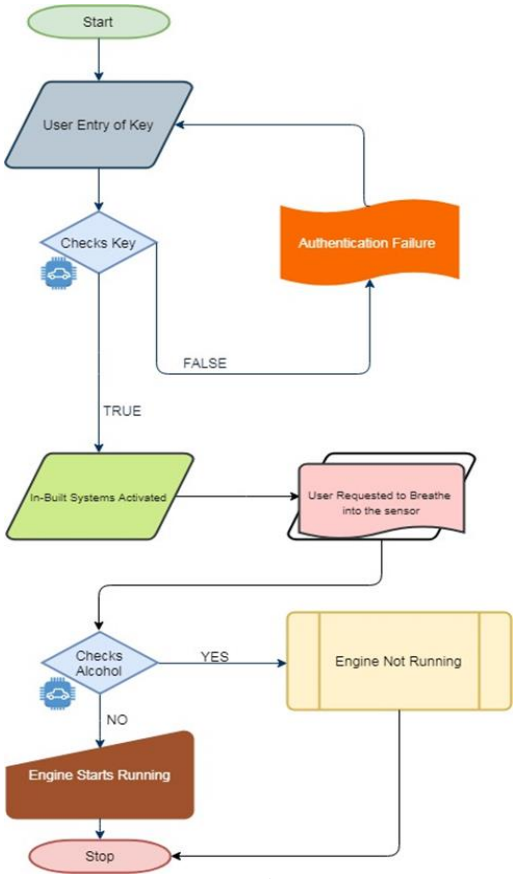

Fig. 6. Flowchart of the entire system

5. Output and screenshot

There are certain parameters that are to be employed during the coding of the project. It begins with the illustration of the keypad layout into the Arduino IDE. We had used the available Keypad in the Proteus library which does not include the keys such as: A, B, C, D instead of which ÷, x, -, + are being adopted for simulation. The input pins allotted in the Arduino are for the keypad and the gas sensor. Both of them accommodate about 9 pin slots in the microcontroller. An additional set of codes are include into the program file to hide the input keys to be displayed on to the LCD screen with '*' sign for user privacy. The locking program drafted for the controller includes a key word entry of 3 characters (initialized i); for that purpose we had devise number keys only. We had used a flag variable which takes vale 1 for an incorrect inputted key and 0 for correct key entry. During the initialization of variables into the program we had fed our key (246); to which on later course evaluation on the library files of Keypad and Proteus modules, we identified a master key of 222, which can be used as custom key for possible retrieval or for multiple user of the vehicle. After authorized entry of key a total of 5 seconds delay is being implanted so as to wait till a complete respiratory cycle of the user ends (to provide a fresh breath into the alcohol analyzer). There are options to improve the system by coding time scaled locking mechanism which will provide effective security

measure in the automobile.

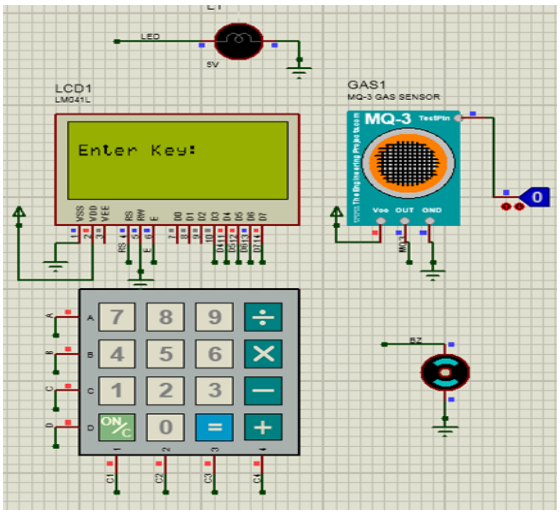

Fig. 7. Entire working circuit from proteus VSM

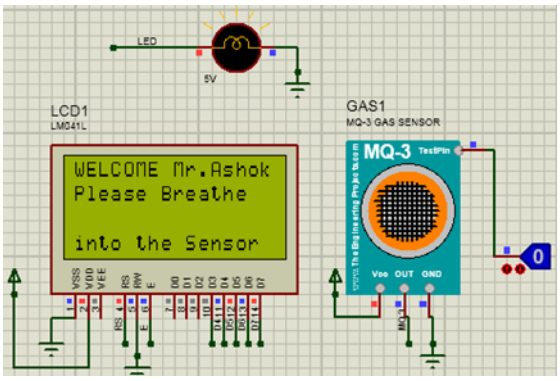

Fig. 8. Authorized pin entry result

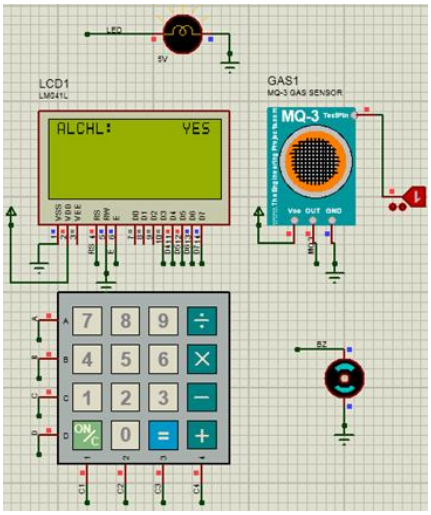

Fig. 9. Alcohol detected authorized user locked in from vehicle engine (DC motor)

From the above simulation and testing, we have evaluated the economic scope of the project on any retail available vehicle and it is found that any frugal personal can afford to install such system into their respective vehicle.

6. Conclusion

This paper presented an overview on automobile security system using Arduino and MQ3 Sensor

Acknowledgment

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