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VEHICLE BLACK BOX AND SECURITY SYSTEM USING MICROCONTROLLER

Prathamesh Narayan Sutar[*1], Rohan Rajesh Raikar[*2], Tejas Deepak Shinde[*3], Sushil Santosh Upadhyay[*4], Narendra Sanjay Davane[*5], Mr. U.J. Maisale[*6]

[*1,2,3,4,5]Students, Dept. Electronics & Communications Engineering, Sharad Institute Of Technology And College Of Engineering, India.

[*6]Assistant Prof.. Dept. Electronics & Communications Engineering, Sharad Institute Of Technology And College Of Engineering, India.

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ABSTRACT

The main reason for this paper is to create a model of the Vehicle Black Box Security System that can be introduced into any vehicle all over the world. This model can be planned with the least number of circuits. The Vehicle Black Box System and Security System can contribute to building more secure vehicles, moving forward the treatment of crash casualties, making a different protection company with their vehicle crash examinations, and upgrading street status in order to diminish the passing rate.

Keywords: Vehicle, Black Box, Microcontroller, GPS, GSM, SD Card.

I. INTRODUCTION

Agreeing to the World Well Being Organization, more than a million individuals within the world pass on each year since of transportation-related mishaps [1]. In order to respond to this circumstance, the black box system draws the primary step to illuminate this issue that crosses national boundaries and debilitates the security and wellbeing of individuals around the world. Presented to a portion of the United States advertise in 1999, the black box system demonstrated to be productive [2]. In any case within the last-mentioned case, the system was implanted within the vehicle [3-5]. Hence, in expansion to progressing the treatment of crash casualties and the street status in arrange to decrease the passing rate, building more secure vehicles, and making a difference protections company with their vehicle mischances examinations, the most reason of this paper is to create a black box system that can be introduced to any vehicle all over the world. Like flight information recorders in flying machines, “black box” innovation can presently play a key part in motor vehicle crash examinations [6]. A significant number of vehicles right now on the streets contain electronic systems that record data within the occasion of a crash. That's why it is so critical to have recorders that impartially track what goes on in vehicles some time recently, amid and after a crash as a complement to the subjective input that's taken ordinarily from casualties, eye witnesses and police reports. This framework is committed primarily to two approaches. The primary one is how to distinguish and record information from the vehicle. The moment is how to display the information recorded to the client in a disentangled way. To execute the primary approach, a few major components and diverse sorts of sensors were utilized. Arduino language gets the information serially from presents it in real-time design and at long last spares it to a formal exceed expectations report for future utilization.

II. HARDWARE RESOURCES

[1] AT Mega 32: The AVR microcontrollers are based on the advanced RISC architecture. ATmega32 is a low power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. AVR can execute 1 million instructions per second if cycle frequency is 1MHz. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The power-down saves the register contents but freezes the oscillator. All other chip functions will be disabled until the next external interrupt arises. Asynchronous timer allows the user to maintain a timer based in power-save mode while the rest of the device is sleeping. ADC noise reduction mode stops the CPU and all I/O modules except ADC and asynchronous timer. In standby mode, except for the crystal oscillator the rest of the device is sleeping. Both the main oscillator and asynchronous timer continue to run in extended standby

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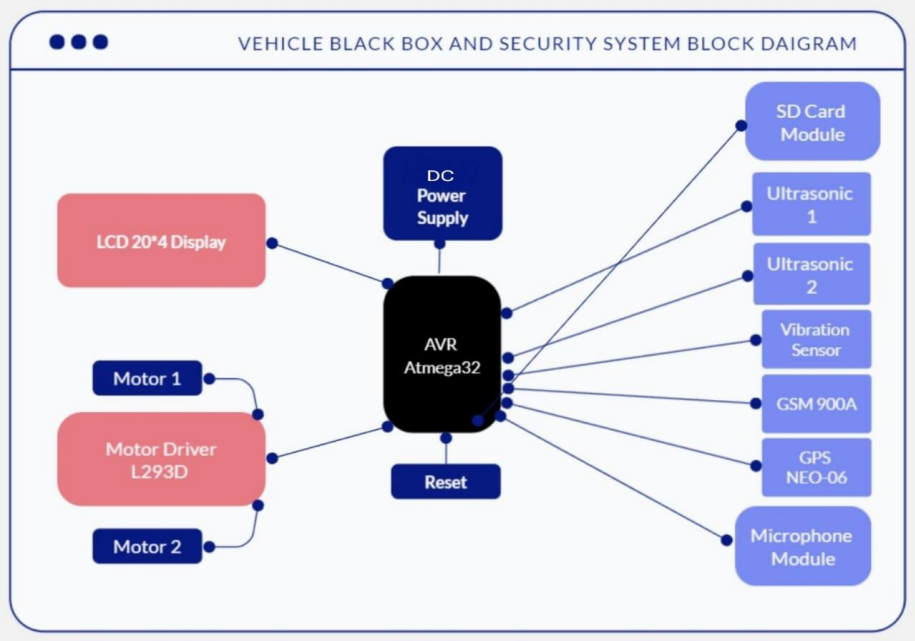
mode. ATmega32 is a powerful microcontroller because of its in system self-programmable flash on a monolithic chip, provides a highly flexible and cost-effective solution to many embedded control applications.

III. BLOCK DIAGRAM



[2] LCD 16*2Display: What is the LCD 16×2? It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light emitting diode and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

- Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- Pin4 (Register Select/Control Pin): This pin toggles among the command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
- Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- Pin 6 (Enable/Control Pin): This pin should be held high to execute the Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller units like 0 to 7.
- Pin15 (+ve pin of the LED): This pin is connected to +5V
- Pin 16 (-ve pin of the LED): This pin is connected to GND.

[3] IR Sensor: The IR Sensor Module or infrared (IR) sensor is a basic and most popular sensor in electronics. It is used in wireless technology like remote controlling functions and detection of surrounding objects/ obstacles. IR sensors mainly consist of an Infrared(IR) LED and a Photodiode, this pair is generally called IR pair. An IR LED is a special purpose LED, it can emit infrared rays ranging from 700 nm to 1 mm wavelength. These types of rays are invisible to our eyes. In contrast, a photodiode or IR Receiver LED detects the infrared rays.IR sensor is an electronic device that emits the light in order to sense some object of the surroundings.

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An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiation are invisible to our eyes, but infrared sensors can detect these radiations. The emitter is simply an IR LED and the detector is simply an IR photodiode . Photodiodes are sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received. There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LEDs of specific wavelength used as infrared sources.

The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response.

[4] Ultrasonic sensor: There are many types of Arduino distance sensors, but in this project, we have used the HC-SR04 to measure distance in range of 2 cm-400 cm with an accuracy of 3mm. The sensor module consists of an ultrasonic transmitter, receiver and control circuit. The working principle of ultrasonic sensor is as follows:

1. High level signal is sent for 10us using Trigger.
2. The module sends eight 40 KZ signals automatically, and then detects whether pulse is received or not.
3. If the signal is received, then it is through a high level. The time of high duration is the time gap between sending and receiving the signal. Distance= (Time x Speed of Sound in Air (340 m/s))/2

Observation Table:

Table 1. Ultrasonic Sensor Readings

Distance (cm)	Actual Reading (cm)	Target Reading (cm)	Variance
10	10.5	10	0.5
20	19.8	20	-0.2
30	30.3	30	0.3
40	41	40	1.0
50	50.5	50	0.5

[5] Alcohol sensor: The MQ3 Alcohol sensor is one of the series of MQ gas sensors, which can detect and monitor the alcohol gas present in the atmosphere. It is capable of detecting 25-500 ppm alcohol gas concentration in the air. This article gives a brief description of the pin configuration, specifications, and Arduino interfacing of the MQ3 alcohol sensor. The alternatives of MQ3 alcohol sensors are MQ138 (benzene, hydrogen, alcohol, propane, toluene, formaldehyde gas), MQ303A (ethanol, smoke, and alcohol), MQ2(methane, smoke, LPG, butane), MQ214 (methane), MQ5 (natural gas and LPG), and MQ306A (LPG and butane). The MQ3 alcohol gas sensor is a module used for detecting alcohol, CH4, benzene, gasoline, hexane, CO, and LPG. It has a sensitive material SnO2 for alcohol gas detection, with lower electrical conductivity in the fresh air. It is a semiconductor alcohol gas sensor that detects or monitors the presence or absence of alcohol. It is also known as chemoreceptors because sensing of the sensitive material depends on the resistance change when the sensor is exposed to alcohol gas.

[6] Max9814 High Performance Microphone AGC Amplifier Module The MAX9814 is a low-cost, high-performance microphone amplifier with automatic gain control (AGC) and low noise microphone bias. The device features a low-noise front-end amplifier, a variable gain amplifier (VGA), an output amplifier, a microphone bias voltage generator, and an AGC control circuit.

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The low-noise preamplifier has a fixed 12dB gain, while the VGA gain automatically adjusts from 20dB to 0dB, depending on the output voltage and the AGC threshold. The output amplifier offers selectable gains of 8dB, 18dB, and 28dB. With no compression, the cascade of the amplifiers results in an overall gain of 40dB, 50dB, or 60dB. A tri-level digital input programs the output amplifier gain.

An external resistive divider controls the AGC threshold and a single capacitor programs the attack/release times. A tri-level digital input programs the ratio of attack-to-release time. The hold time of the AGC is fixed at 30ms. The low-noise microphone-bias-voltage generator can bias most electric microphones.

[7] SD card Module: Micro SD Card Reader Module also called Micro SD Adaptor which is designed for dual I/O voltages. The Module is a simple solution for transferring data to and from a standard SD card. The pin out is directly compatible with Not only with Arduino as shown in the diagram below, but can also be used with other microcontrollers. Micro SD Card Reader Module has an SPI interface which is compatible with any sd card and it uses 5V or 3.3V power supply which is compatible with Arduino UNO/Mega.SD module has various applications such as data logger, audio, video, graphics.

There are total of six pins (GND, VCC, MISO, MOSI, SCK, CS), GND to ground, VCC is the power supply, MISO, MOSI, SCK is the SPI bus, CS is the chip select signal pin; 3.3V regulator circuit: LDO regulator output 3.3V as level converter chip, Micro SD card supply.

Features:

1. Support Micro SD Card (<=2G), Micro SDHC card (<=32G) (high-speed card)
2. The level conversion circuit board that can interface level is 5V or 3.3V
3. Power supply is 4.5V ~ 5.5V, 3.3V voltage regulator circuit board
4. Communication interface is a standard SPI interface.

Observation Table :

Table 2. Overall Sensor Readings.

Metric	Actual Reading	Target Reading	Variance
Speed	65 mph	60 mph	5 mph
Acceleration	2.5 m/s^2	2.0 m/s^2	0.5 m/s^2
Gyroscope	10°/s	5°/s	5°/s
Alcohol sensor	0.1 mg/L	0.0 mg/L	0.1mg/L
Vibration Sensor	100 counts	50 counts	50 counts

IV. SOFTWARE RESOURCES

Setup and Loop Functions: In an Arduino sketch (the term used for Arduino programs), there are two essential functions: setup () and loop (). The setup () function is called once at the beginning of the program to initialize variables and settings, while the loop () function is continuously executed in a loop after setup () completes.

Pin Management: Arduino boards have various digital and analog pins that can be used to interact with external components. You can use functions like digital Write (), digital Read (), analogWrite (), and analogRead () to work with these pins.

Library Support: Arduino provides a wide range of libraries that simplify interactions with sensors, actuators, displays, communication protocols (like I2C, SPI), and more. These libraries abstract complex code into simple function calls.

Data Types and Functions: The Arduino language supports common data types such as integers, floating-point numbers, characters, and arrays. It also includes basic control structures like loops (for, while) and conditional statements (if-else).

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Serial Communication: Arduino sketches often use serial communication to send and receive data between the board and a computer. The Serial object and functions like Serial. Begin (), Serial. Print (), and Serial. Read () are commonly used for this purpose.

Project Pictures:

V. CONCLUSION

Here we are using only the accident detection part of the BLACK BOX. We can save the vehicle data in sd card memory. Here for project purposes, we are using the piezoelectric sensor but in a practical situation there should be a strong detector. We can use this project on a practical basis by putting the value of longitude and altitude on a smartphone so we can get the accurate location of the accident. Also, we can use a software to directly view the place on mobile. From the GPS system we can monitor the velocity but here we are not using that part. Also we use the lcd screen in the prototype which can be replaced by an integrated display inside a vehicle.

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