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Research Paper

Atmel microcontroller And Arduino Mega controller -Based Wireless Vehicle Alert and Collision Prevention System

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ABSTRACT: *Compared to the previous ten years, the rate of car accidents has been rising recently. There has been a 54% rise in the accident rate. The response time following an accident is reduced by this system. This study addresses such a collision detection and prevention system. This paper describeshow to effectively use an SMS alert system to construct a security system for moving cars. The systemis distinct from the others since it makes use of a microcontroller. The components utilized in the suggested task involve sending SMS messages, storing phone numbers, and recognizing accidents. TheAtmel microcontroller AT89S52 handles all of the tasks involved in managing the embedded system microcontroller. The components utilized in the suggested task involve sending SMS messages, storing phone numbers, and recognizing accidents. The Atmel microcontroller AT89S52 handles all of the tasksinvolved in managing the embedded system.*

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KEYWORDS: *GSM, embedded system, microcontroller, SMS system, vibration sensor*

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I. INTRODUCTION

In an era marked by rapid technological advancements, ensuring road safety remains a paramount concern. With the increasing complexity of vehicular traffic and the rising number of vehicles on the roads, the need for robust collision prevention systems has never been more urgent. In response to this imperative, the Atmel microcontroller-based wireless vehicle alert and collision prevention system emerges as a pioneering solution, poised to redefine automotive safety standards.

The primary objective of this system is to mitigate the risk of collisions by providing real-time alerts to drivers, thereby enhancing situational awareness and facilitating timely evasive actions. By leveraging the power of Atmel microcontrollers and wireless communication technologies, this system transcends traditional passive safety measures, actively intervening to prevent accidents before they occur

The system operates on a multi-faceted approach, utilizing a network of sensors, microcontrollers, and wireless transceivers to gather and disseminate crucial information in real time. Key functionalities include:
Collision Detection: Employing a combination of proximity sensors and onboard processing capabilities, the system continuously monitors the surrounding environment for potential collision hazards
Alert Generation: Upon detecting a potential threat, the system promptly generates audio-visual alertswithin the vehicle cockpit, alerting the driver to take evasive actions.
Wireless communication: Through seamless wireless communication protocols, the system exchanges critical data with neighboring vehicles equipped with compatible systems, enabling collaborative collision avoidance strategies.

II. SYSTEM DESCRIPTION

2.1. HARDWARE DESCRIPTION:

The tackle bedded system used in the proposed paper has the block illustration as shown in Fig 1. The factors used in the proposed work are related to detecting the accident, saving the phone figures, and transferring the SMS. The major element is the Atmel microcontroller AT89S52 which performs all the operations related to controlling the bedded system circuit. GSM module is used to shoot the SMS alert to the mobile using AT commands which are connected to the microcontroller, through, MAX232.

3[GSM Framework Designing (Artech House Portable Communications Arrangement) by Asha K. Mehrotra.] Discovery of.The accident is performed using a vibration detector,801S shock detector which is connected through MCP 3208. MCP 3208 is an analog to digital motor block that gives digital affair to the microcontroller. The phone figures of the mobile to which this SMS alert has to be transferred are stored in EEPROM, AT24C08.

The operations performed during the process of transferring the SMS is done by the keypad

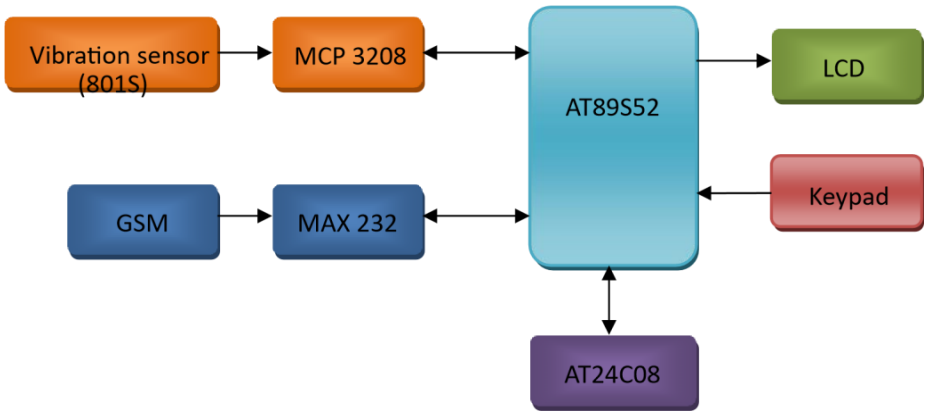

FIG 1: BLOCK DIAGRAM

2.2. SOFTWARE DESCRIPTION :

The comity of the system performance is executed using the software. Programming the microcontroller is performed in Bedded C language. The program is collected and run through the KEIL C compiler. The HEX train is generated concerning the collected law using ISP Programmer and this train is ditched onto the microcontroller.

2.3. ATMEL ISP FLASHOVER PROGRAMMER :

This is the software that will take the HEX train generated by whatever compiler is taken, and shoot it concerning the veritably specific ISP transfer protocol to the microcontroller. This programmer is flexible, provident, and easy to make. The programmer tackle uses the standard TTL series corridor withno special factors. The programmer is connived with the PC resemblant harborage and there's no special demand for the PC resemblant harborage, so the aged computers can also be used with this programmer.The main screen view of the program is shown in Fig 2.

The features of the software are:

1. Read and write the Intel Hex documents
2. Read hand, cinch, and fuse bits
3. Clear and Fill the memory buffer
4. corroborate with a memory buffer
5. Reload the current Hex train
6. Display buffer checksum
7. Program named cinch bits & fuses
8. bus discovery of tackle

The memory buffer contains both the code information and the EEPROM information for the gadgets which have EEPROM memory. The EEPROM memory address in the buffer begins after the code memory, so the hex record must contain the EEPROM begin address after the conclusion of the code memory final address. The computer program does not give the delete command since this work is performed consequently amid gadget programming. If it is required to delete the controller, at first the clear buffer command is performed taken after by programming the controller. This deletes the controller and conjointly sets the gadget to the default setting. The ISP software engineer is shown in Fig 3.

FIG 2: ATMEL PROGRAMMER

2.4 ARDUINO MEGA CONTROLLER:

Arduino

Arduino is a prototype platform (open-source) based on easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller), and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer codeto the physical board.

The key features are −

- Arduino boards can read analog or digital input signals from different sensors and turn them into an output such as activating a motor, turning LED on/off, connecting to the cloud, and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the microcontroller intoa more accessible package.

Board Types

Various kinds of Arduino boards are available depending on the different microcontrollers used. However, all Arduino boards have one thing in common: they are programmed through the Arduino IDE.

The differences are based on the number of inputs and outputs (the number of sensors, LEDs, and buttons you can use on a single board), speed, operating voltage, form factor, etc. Some boards are designed to be embedded and have no programming interface (hardware), which you would need to buy separately. Somecan run directly from a 3.7V battery, others need at least 5V.

we will learn about the different components of the Arduino board. We will study the Arduino UNO board because it is the most popular board in the Arduino board family. In addition, it is the best board to get started with electronics and coding. Some boards look a bit different from the one given below, but most Arduinos have the majority of these components in common.

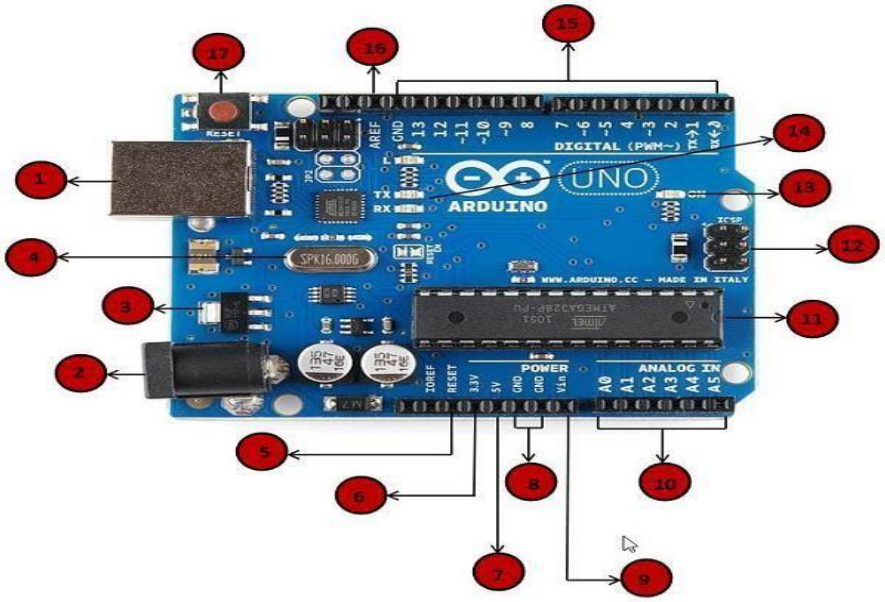

FIG 3: ARDUINO MEGA CONTROLLER

1. Power USB

Arduino board can be powered by using the USB cable from your computer. All you need to do is connectthe USB cable to the USB connection (1).

2. Power (Barrel Jack)

Arduino boards can be powered directly from the AC mains power supply by connecting it to the BarrelJack (2).

3. Voltage Regulator

The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize theDC voltages used by the processor and other elements.

4. Crystal Oscillator

The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? Theanswer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.

4. Arduino Reset

You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an externalreset button to the Arduino pin labeled RESET (5).

5. Pins (3.3, 5, GND, Vin)

- 3.3V (6) − Supply 3.3 output volt

6. Analog pins

The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from ananalog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can beread by the microprocessor

7. Main microcontroller

Each Arduino board has its microcontroller (11). You can assume it is the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details aboutthe IC construction and functions, you can refer to the datasheet

8. ICSP pin

Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which couldbe considered as an "expansion" of the output. You are slaving the output device to the master of the SPI bus.

9. Power LED indicator

This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.

III . SYSTEM LEVEL DESIGN AND IMPLEMENTATION:

The framework works on the guideline of vibration sensor which identifies the mischance to the vehicle by detecting the vibration happening due to the mishap. This yield is given to MCP 3208 which changesover the analog shape into a computerized one. This 2785 advanced yield is checked with the edge esteem. On the off chance that the value surpasses the edge, GSM is enacted. The corresponding key is squeezed on the keypad to choose the phone number stored in EEPROM. AT2408 acts as the capacity gadget for the phone numbers. An SMS alarm is sent to the chosen number using GSM (SIM 300). Themethod is delineated with the flow chart as appeared in.

FIG 3 GSM MODULE

The proposed inserted framework appears in Fig 9

FIG 4: ATMEL MICROCONTROLLER-BASED KEYBOARD

The keypad is used to choose the specified number to which an SMS has to be sent. The numbers can be put away in EEPROM and by programming the module, an SMS is sent directly to the put-away numbers. The data contains the goal where a mishap has happened utilizing GPRS. The nonattendance of GPRS alarmsthe concerned individual concerning the mishap that happened within the area

SYSTEM-LEVEL DESIGN OF ARDUINO MEGA CONTROLLER

3.1 LCD INTERFACE WITH MICRO CONTROLLER

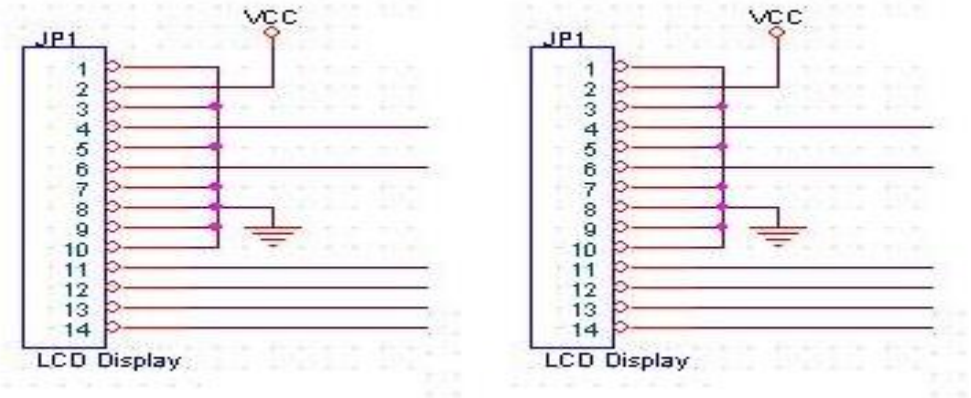

FIG 5 LCD INTERFACE WITH MICROCONTROLLER

INTERFACING LCD TO MICROCONTROLLER

The LCD is generally interfaced in 8-bit mode or 4-bit mode. in this project LCD is connected in 4-bit mode the interface connections of LCD with the microcontroller are as follows RS of LCD is connected to p0.0 of the microcontroller.

EN of LCD is connected to p0.1 of the microcontroller

D4 of LCD is connected to p0.4 of the microcontrollerD5 of LCD is connected to p0.5 of the microcontrollerD6 of LCD is connected to p0.6 of the microcontroller

3.1.2 BUZZER INTERFACE WITH MICROCONTROLLER

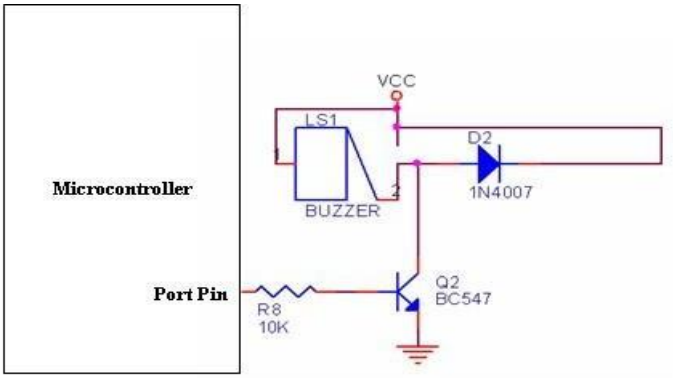

FIG 5 BUZZER INTERFACE WITH MICROCONTROLLER

RS232

The most popular serial communication standard for asynchronous communications is RS-232 (Recommended Standard – 232. This specifies the rule of how different connected devices communicate. The connected devices can either be terminals or communication equipment commonly referred to as DTE & DCE. According to the RS232 interface, it requires only 3 lines i.e. Rx, Tx & Ground when compared to the bunch of connectors required for parallel communication. Even though parallel communication is easier to establish, serial communication is preferred based on the costs of the communication lines.

The EIA (Electronics Industry Association) RS232C Standard specifies & suggests a maximum baud rate of 20,000bps, and RS232D is an advanced version of the same, which allows 1.5 Mbps. The connectors specifiedare D-TYPE 25-pin connector and D-TYPE 9-pin connector.

FIG 6 BUZZER

Piezo Electric buzzers are Solid-state devices that produce an Audible signal when powered.
_ They are made up of piezo crystal.
_ The fundamental property of Piezo crystal states that when a voltage is applied to the crystal in a particular plane. It enters into oscillations.
_ A simple oscillator circuit is used to make these signals audible.
Piezoelectric buzzers operate right from 3V up to 24V DC. Similar to the LED drive, a transistor driveris used for driving the load. The other advantage of this scheme is that the drive voltage can be much higher than the operating voltage of the microcontroller.
A protection diode is included in all inductive load circuits to prevent the back emf from damaging the driving transistor & subsequently the microcontroller.

3.1.3 MAX 232 INTERFACE WITH MICRO CONTROLLER

MAX232 is connected to the microcontroller as shown in the figure above 17, 18 pins are connected tothe TX and RX pin i.e. transmit and receive pin of the microcontroller Global System for Mobile Communication (GSM)

Definition:

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz.

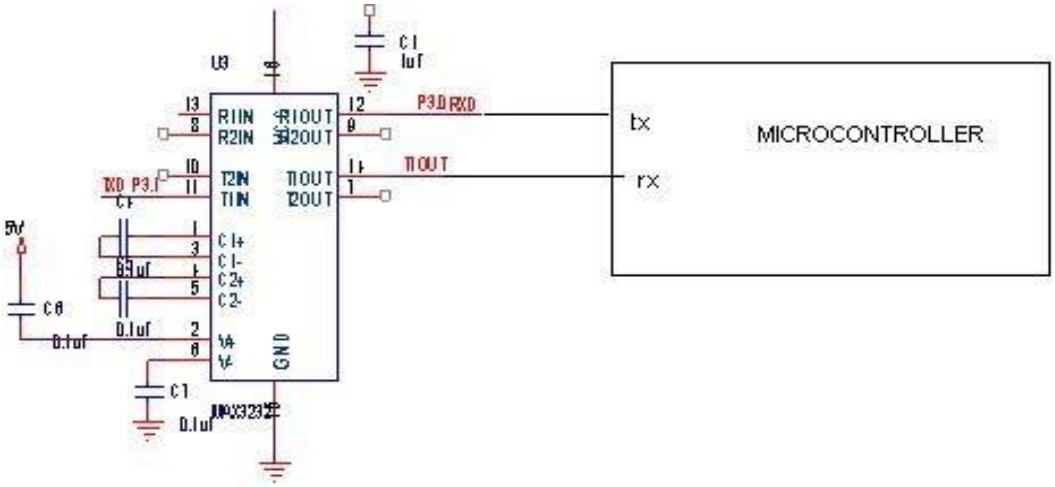

FIG 7 RS232 INTERFACE WITH MICROCONTROLLER

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer.

Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier to operate.

As mentioned in earlier sections of this SMS tutorial, computers use AT commands to control modems. Both

GSM modems and dial-up modems support a common set of standard AT commands. You can use a GSM modem just like a dial-up modem.

In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, youcan do things like:

- Reading, writing, and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.
- Monitoring the charging status and charge level of the battery.
- Reading, writing, and searching phone book entries.

The number of SMS messages that can be processed by a GSM modem per minute is very low -- only about six to ten SMS messages per minute.

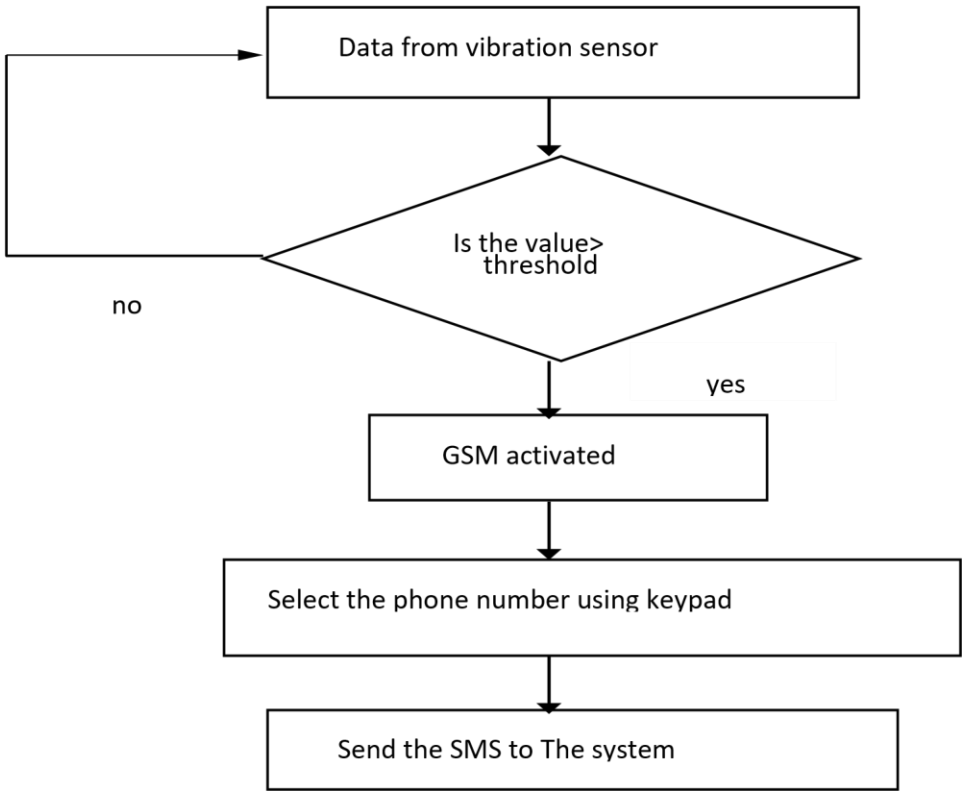

FIG 8: FLOW CHART OF GSM SIGNAL TRANSMISSION

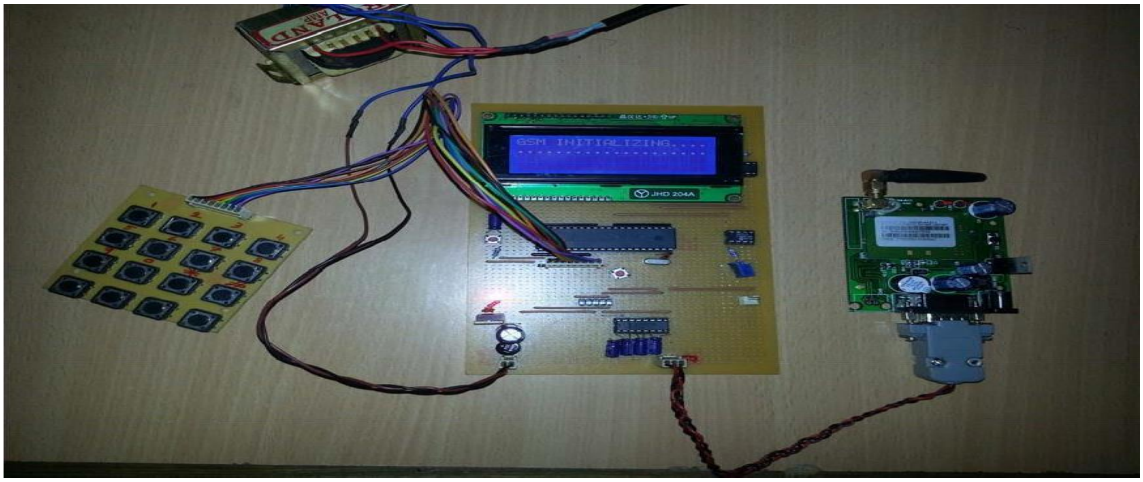

FIG9: HARDWARE CIRCUIT OF ATMEL MICROCONTROLLER

When designing the hardware circuit for an Atmel microcontroller-based system, several essential components need to be considered to ensure proper functionality, reliability, and integration with peripheral devices. Here's an overview of the key hardware circuit components typically associated withan Atmel microcontroller:

ATMEL MICROCONTROLLERPOWER SUPPLY CIRCUIT
CLOCK SOURCERESET CIRCUIT
PERIPHERAL INTERFACE CIRCUIT

ANALOG INPUT/OUTPUT CIRCUITEXTERNAL PERIPHERAL CIRCUIT

IV. CONCLUSION:

In conclusion, the Atmel microcontroller-based remote vehicle alarm and collision anticipation framework speaks to a noteworthy progression in car security innovation. Through the integration of state-of-the-art equipment and brilliantly computer program calculations, this framework epitomizes a proactive approach to relieving the hazard of collisions on the road. All through this report, we have investigated the complexities of the system's plan, from its strong sensor clusters to its consistent remote communication capabilities. We have illustrated its capacity to distinguish and respond to potential collision dangers in real time, enabling drivers with the information and devices required to explore dangerous circumstances safely. Besides, the collaborative nature of this framework, encouraged by itsremote communication conventions, holds the guarantee of cultivating a collective biological system of vehicle security, where data sharing and agreeable techniques clear the way for improved street security for all. As we look to the longer-term Atmel microcontroller-based remote vehicle alarm and collision avoidance framework stands balanced to create a significant effect on the car industry. Its potential to spare lives, decrease mischances, and revolutionize the way we approach street security underscores its noteworthiness as a spearheading innovation within the journey for more secure streets worldwide. In closing, let us grasp this framework not only as an innovative development but as a confirmation of ourimmovable commitment to defending human lives and guaranteeing a more secure, more secure futurefor eras to come

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