JSRT JOURNAL

PAGES: 286-296
09/07/25

JOURNAL OF SCIENTIFIC RESEARCH AND TECHNOLOGY VOLUME-3 ISSUE-7 JULY

Safe Lane IoT

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ABSTRACT

The Accident Detection and Assistance System with Blind Spot Detection is a safety system designed to reduce accidents and improve vehicle safety using a variety of sensors. This system utilizes an Arduino Uno, I2C LCD, ultrasonic sensors for obstacle and blind spot detection, an alcohol sensor for driver condition monitoring, a piezo sensor for accident detection, and a GSM module (SIM900) for emergency communication. The system alerts the driver in case of obstacles, blind spot hazards, alcohol consumption, and accidents. Additionally, it sends SMS notifications to an emergency number in case of critical incidents. This project aims to enhance the safety of the driver and others on the road.

Keywords: IOT, Road safety, Blind Spot Detection.

I. INTRODUCTION

Accidents are one of the leading causes of fatalities worldwide. The rise in road accidents has prompted the need for systems that can assist drivers and ensure their safety. Modern vehicles are increasingly equipped with safety features, but many of them are not readily accessible to older or budget vehicles. This project aims to create a low-cost, effective accident detection and assistance system to reduce accidents caused by blind spots, obstacles, and driver conditions like alcohol consumption. The system uses a combination of sensors, an emergency switch, and real-time alerts via sms to ensure the vehicle's safety.

According to Indian perspective there are mobile apps in the market developed for the safety of women specifically designed for android or iOS, some of which have paid premium features that may help to save a life in threatening situations, for example, apps like ‘VithU’, ‘Smart Shehar’ etc. allows one to send SOS alerts to the listed contacts by just pressing the power button of the phone twice or even take the picture. It also sends the GPS location of the incident or where the victim is present. Problems associated with these smart phone applications are that, if awoman gets into any trouble then she might not be able to use her hands to activate the app and send her location because in most cases the attacker firstly grab victim’s hand and close her eyes too. Apart from several mobile apps some built in smart devices are there for safety of women. Such like a smart self-defense watch for women safety [1] which uses Atmega 328 Microcontroller and has GPS module inside it to detect the location and display it on the watch, it also comprises a voice recognition module that saves the audio inside a sim card and sends it to the nearby police station that can be further used as evidence. Concept of this watch is undoubtedly a good concept but practically it is difficult to assemble all the modules in a small watch which are described in the work.

1.1 METHODOLOGY

The project follows a step-by-step approach for implementation:

1. **System Design**: Initial hardware setup using Arduino Uno, sensors (ultrasonic, alcohol, piezo), and GSM module.
2. **Programming**: Writing the Arduino code to integrate sensor data processing and decision-making. The system will process ultrasonic readings to detect obstacles and blind spots, alcohol levels to detect impairment, and piezo sensor data for accident detection.
3. **Testing and Calibration**: Calibrating sensors for accurate readings (distance for ultrasonic sensors, alcohol concentration levels, and impact sensitivity for piezo sensors).
4. **SMS Notification**: Configuring the GSM module to send SMS alerts to an emergency contact when critical events are detected.

II. SYSTEM OVERVIEW

The fig.1 shows block diagram which gives you the overview of the proposed system. The brief description given bellow.

2.1 BLOCK DIAGRAM

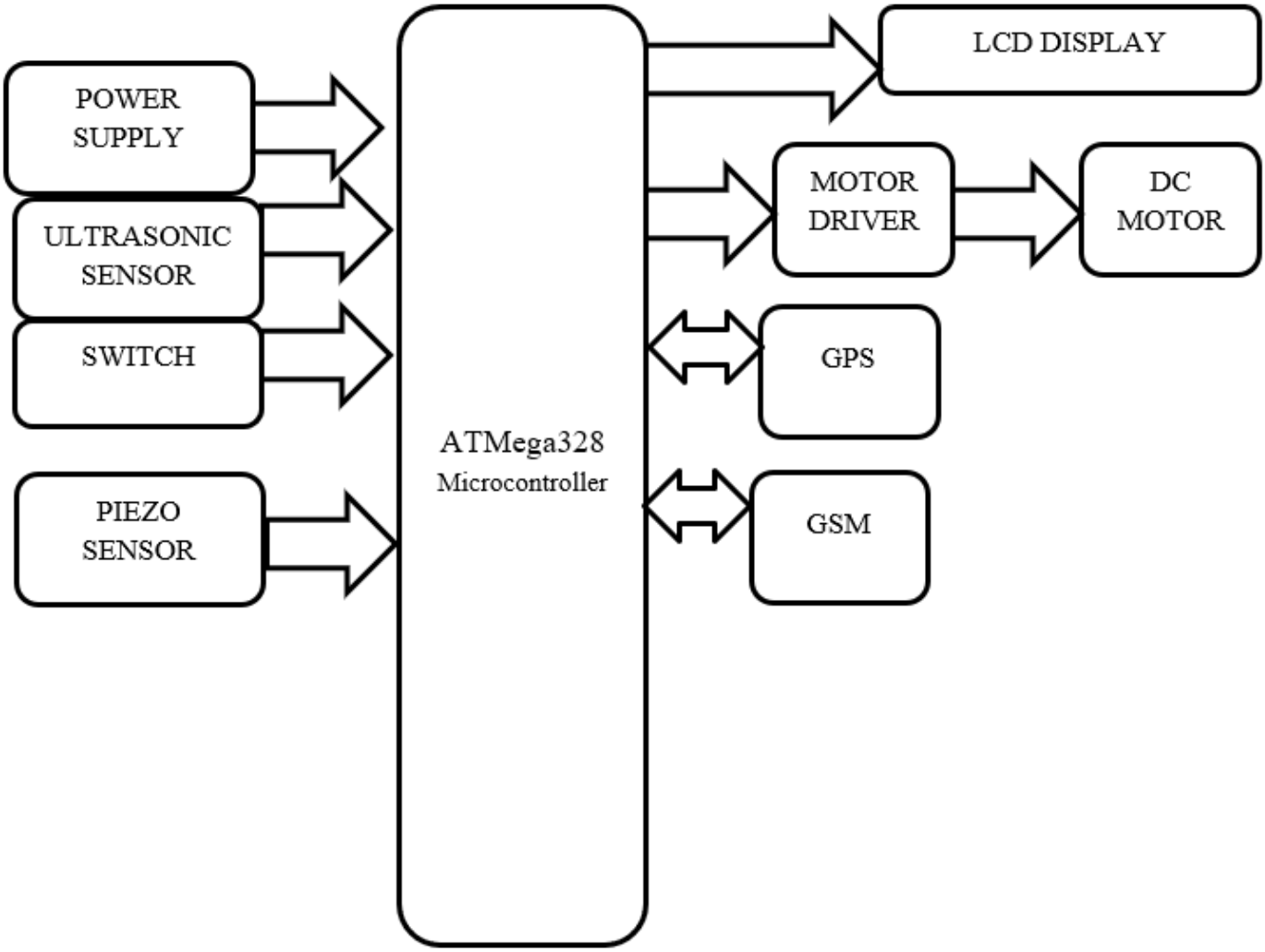


Figure 2.1: Block Diagram of the Project

III. MICROCONTROLLER

3.1 Introduction

To make a complete microcomputer system only micro controller is not sufficient, it is necessary to add other peripherals such as read only memory (ROM), read / write memory (RAM), decoders, drivers, latches, number of input / output devices to make a complete microcomputer system. In addition, special purpose devices, such as interrupt controller, programmable timers, programmable I/O devices, DMA controllers, USART/UART, programmable keyboard/display drivers may be added to improve the capability, performance and flexibility of a microcomputer system. In addition battery backup and an elaborate power supply arrangement is essential. However the key feature of micro controller based computer system is that, it is possible to design a system with a great flexibility

Simplified block diagram of 8051 family microcontroller

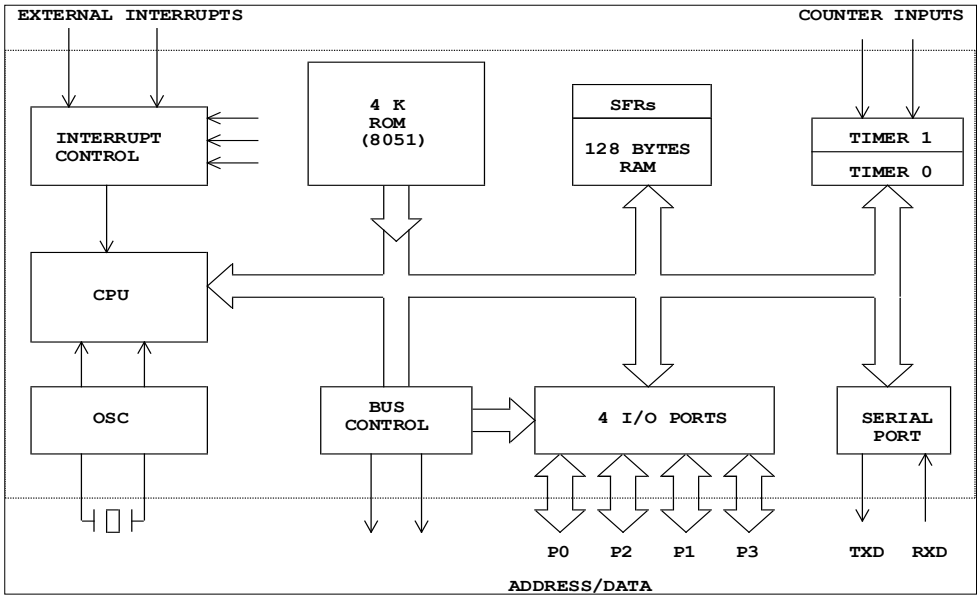


Figure 3.1: Block diagram of 8051 family microcontroller

As shown in the above figure the micro controller has on-chip (built-in) peripheral devices. These on chip peripherals make it possible to have single-chip microcomputer system.

3.3 Pin Description of ATmega328 Microcontroller:

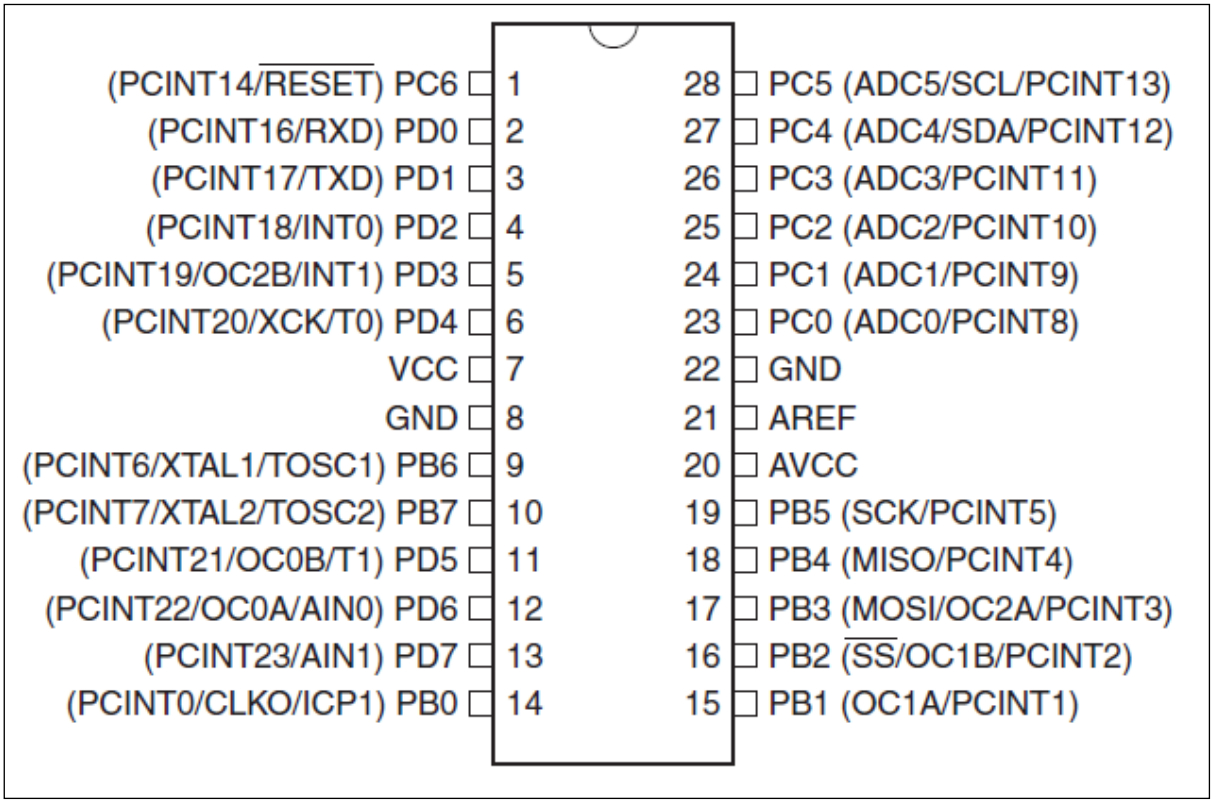


Figure 1.3.1: Pin diagram of ATmega328 MC

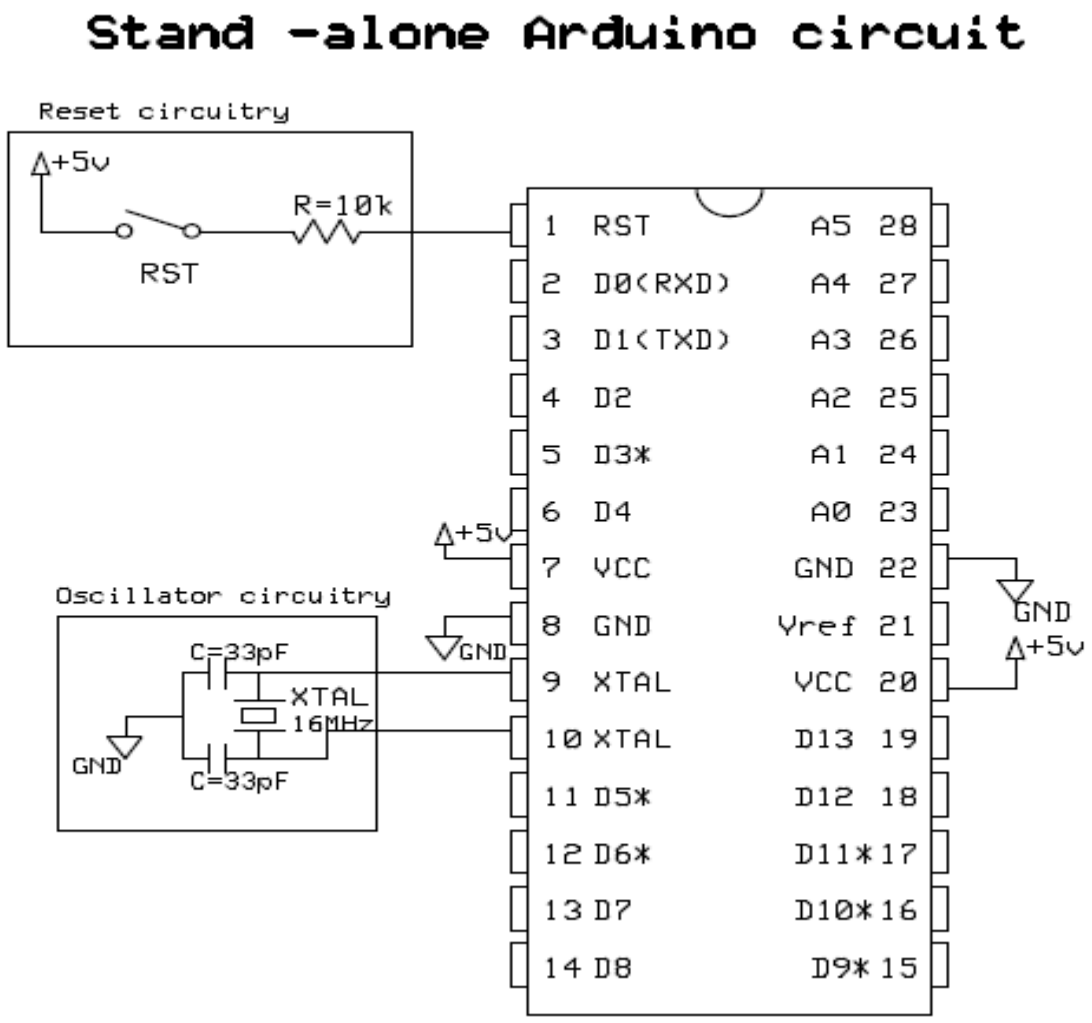


Figure 3.3.2: Stand-alone ATmega328 microcontroller

AN OVERVIEW OF ARDUINO NANO BOARD

This article gives detailed information about an Arduino Nano board, and it is one kind of microcontroller board which is designed by the Arduino team. This microcontroller is based on Atmega168 or Atmega328p. It is fairly similar to Arduino Uno board but when it comes to pin-configuration and features, this nano board has replaced Arduino Uno due to small in size. As we know that while designing an embedded system small size components are preferred. Arduino boards are mainly used to build electronic projects. embedded systems, robotics, etc. But the nano boards are mainly introduced for the beginners who are not from the technical background.

IV. SENSOR & COMPARATORS

Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically.

Criteria to choose a Sensor

There are certain features which have to be considered when we choose a sensor. They are as given below:

1. Accuracy
2. Environmental condition - usually has limits for temperature/ humidity
3. Range - Measurement limit of sensor
4. Calibration - Essential for most of the measuring devices as the readings changes with time

5. Resolution - Smallest increment detected by the sensor
6. Cost
7. Repeatability - The reading that varies is repeatedly measured under the same environment

V. COMMUNICATION

Communication is the activity of conveying information through the exchange of messages, or information. The system which is to displays the next station information. To establish the communication between the station and Train we using RF communication system.

5.1 Block diagram of Communication System

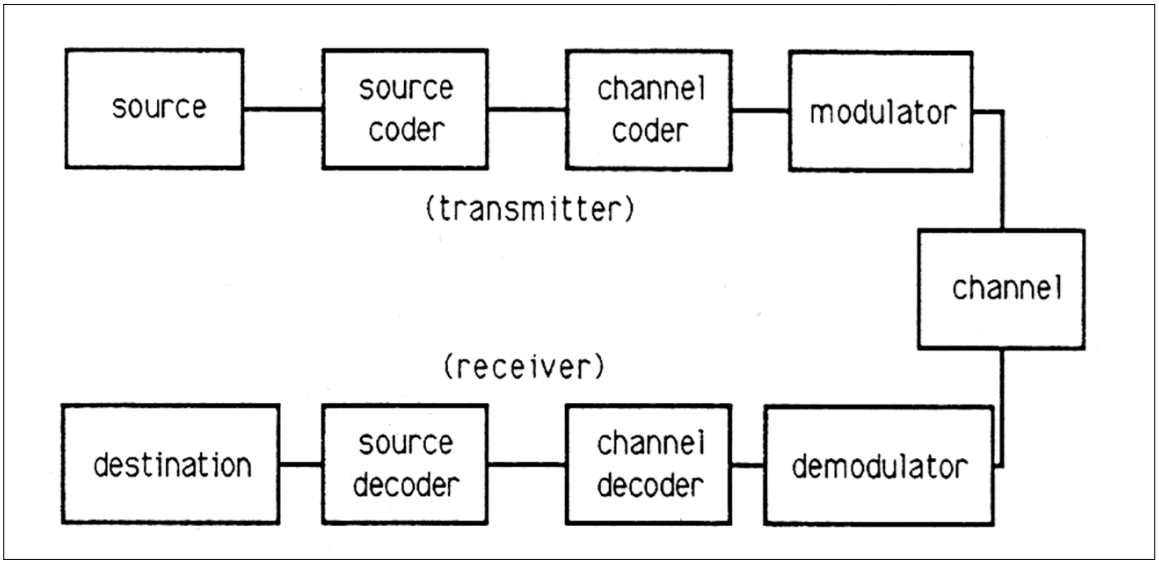


Figure 5.1: Block diagram of Communication System

5.2 GSM Technology

GSM module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer.

WIRELESS MODEMS

Wireless MODEMs are the MODEM devices that generate, transmit or decode data from a cellular network, for

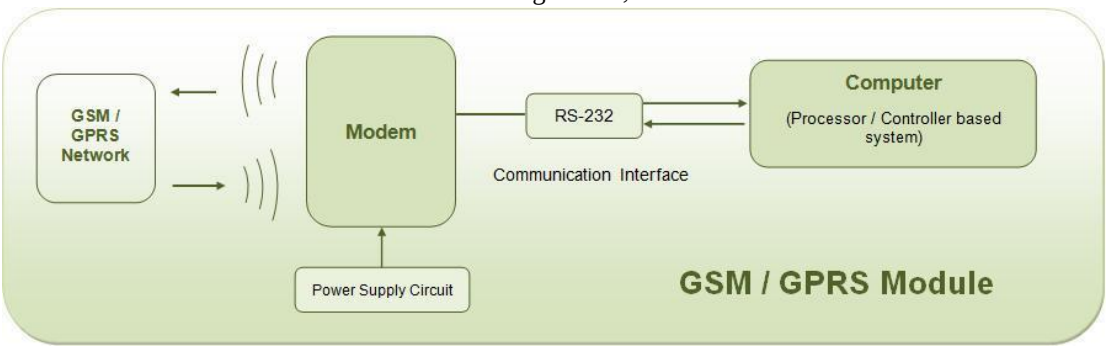


Figure 5.2.1: General block diagram of GSM/GPRS Module interfaced with computer

establishing communication between the cellular network and the computer. These are manufactured for specific

cellular network (GSM/UMTS/CDMA) or specific cellular data standard (GSM/UMTS/GPRS/EDGE/HSDPA) or technology (GPS/SIM). Wireless MODEMs like other MODEM devices use serial communication to interface with and need Hayes compatible AT commands for communication with the computer (any microprocessor or microcontroller system).

GSM MODEM

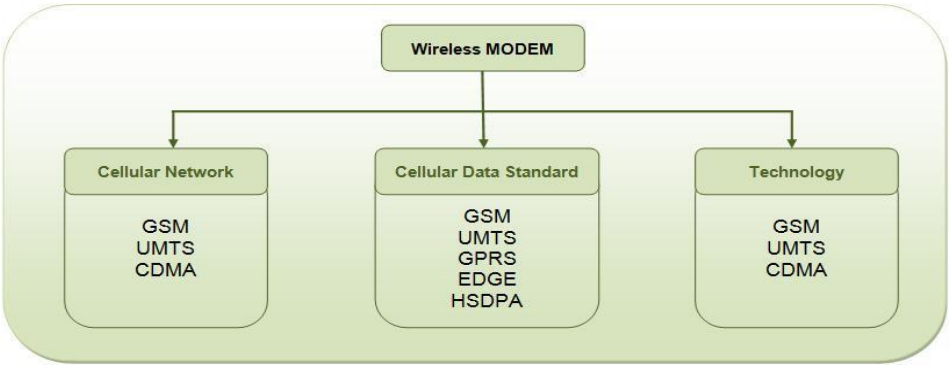


Figure 5.2.2: Classification of wireless Modems

GSM MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations:

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.

The MODEM needs AT commands, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the GSM and GPRS cellular network.

GSM Module

A GSM module assembles a GSM modem with standard communication interfaces like RS-232 (Serial Port), USB etc., so that it can be easily interfaced with a computer or a microprocessor / microcontroller-based system. The power supply circuit is also built in the module that can be activated by using a suitable adaptor.

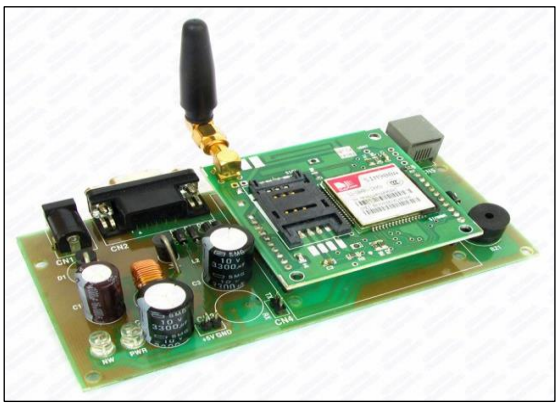


Figure 5.2.3: GSM Module (With serial converter port)

Mobile Station (Cell phones and SIM)

A mobile phone and Subscriber Identity Module (SIM) together form a mobile station. It is the user equipment that communicates with the mobile network. A mobile phone comprises of Mobile Termination, Terminal Equipment and Terminal Adapter.

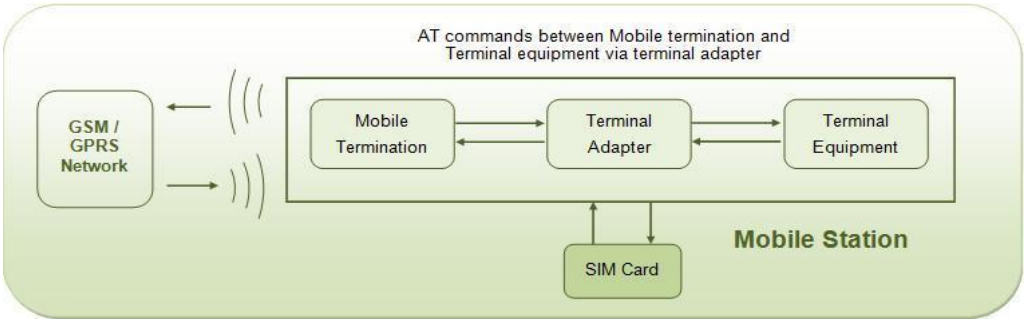


Figure 5.2.3: Mobile station and communication network

Mobile Termination is interfaced with the GSM mobile network and is controlled by a baseband processor. It handles access to SIM, speech encoding and decoding, signaling and other network related tasks. The Terminal Equipment is an application processor that deals with handling operations related to keypad, screen, phone memory and other hardware and software services embedded into the handset. The Terminal Adapter establishes communication between the Terminal Equipment and the Mobile Termination using AT commands. The communication with the network in a GSM/GPRS mobile is carried out by the baseband processor.

Different Result Codes:

RESULT CODE	DESCRIPTION
OK	Successful Execution of a command
ERROR	Execution of a command failed
+CMS ERROR	Message service failure, is returned with an error code
Unsolicited Result Codes	
+CDS	Notify receipt of SMS status report of a new message to computer
+CDSI	Notify receipt of SMS status report of a new message and its location in memory to computer
+CMT	Notify forwarding of a new SMS to computer
+CMTI	Notify receipt of SMS status report of a new message and its location in memory to computer

VI. HARDWARE IMPLIMANTATION

6.1 Regulated Power Supply Unit

Definition:

A power supply (sometimes known as a regulated power supply unit or RPSU) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

6.1.1 Block diagram

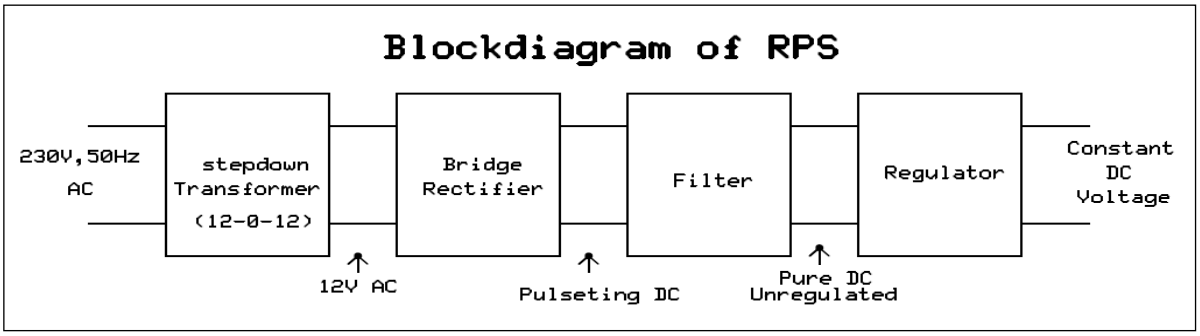


Figure 6.1.1: Block diagram of Regulated Power supply Unit

- The first section is the transformer. The transformer steps up or steps down the input line voltage and isolates the power supply from the power line.
- The rectifier section converts the alternating current input signal to a pulsating direct current. However, as you proceed in this chapter you will learn that pulsating dc is not desirable.
- For this reason a filter section is used to convert pulsating dc to a purer, more desirable form of dc voltage.
- 78xx chip family gives different output voltage as regulator. The last numbers in the chip code tells the output voltage.

VII. SOFTWARE DEVELOPMENT

SOFTWARE INSTALLATION

Installing ARDUINO IDE

To install the Arduino IDE for Windows, follow these instructions:

1. Download .exe file from website: http://arduino.cc/en/Main/Software/
2. Once the download is complete, double-click the file, and extract it.
3. The extracted “Arduino” named folder is to be copy and paste it into C-Drive, and Open the folder, if you wish create the shortcut of Arduino.exe file on your desktop.

APPLICATIONS

- Provide parents with a sense of security for their child in today's time.
- Can be used for the safety of physically challenged & elderly aged people.
- Used for tracking soldiers.
- Ensures women’s safety.
- Can be used for tracking pets or wild animals.
- Live location tracking can be used as a legal evidence of crime with exact location information for prosecution.

7.1 FUTURE WORKS

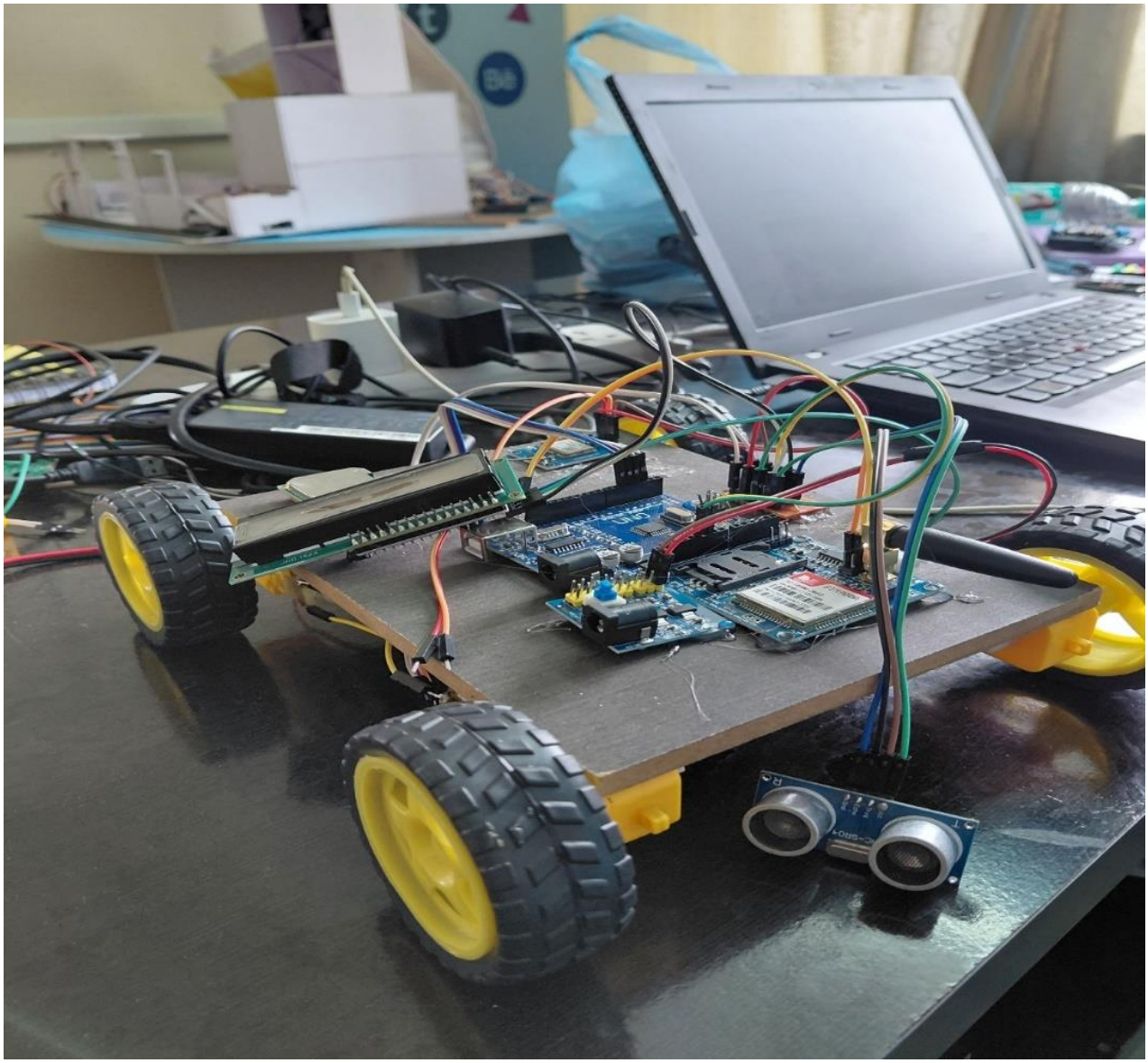
We can also implement this in android watches, attached to other IoT concepts like home security, structural health, city energy consumption, smart lighting and so on.

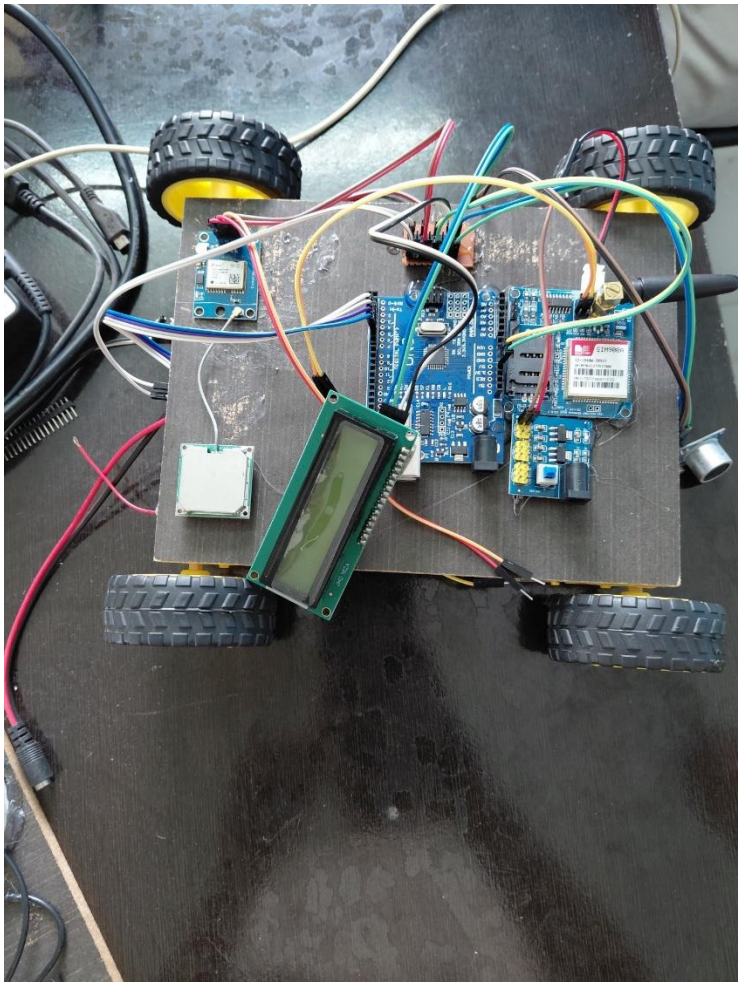
7.2 SYSTEM OUTPUT AND DISCUSSION

System will start to work as soon as the user activates the push button located on pendant or at the right shoe. The system will send an SOS alert SMS to 5 prestored numbers using the GSM module used in this device. In figure it can be seen that the device sends a message 'PLZ HELP ME' to 5 numbers as stored by the user along with the latitude and longitude value of the present location of the victim. In this device victim's real time location can be tracked and traced.

It is possible if the show receives 'Send.Loc' message from any of the 5 pre-stored numbers. In revert to that SMS the device or the show will send its real time location, so that it can be tracked in a real time manner. The message also comprises the Google Map [14] link with which the receiver of the message can easily find the location of the victim using Google map [14] just in a click. In figure the Google map view can be seen. The device is also capable of calling, using the GSM module

VIII. RESULT AND DISCUSSION





IX. CONCLUSION

The Accident Detection and Assistance System with Blind Spot Detection successfully integrate various safety features in one low-cost system using Arduino Uno. It provides real-time alerts for obstacle detection, blind spot monitoring, alcohol detection, and accident detection. The addition of GSM communication makes this system even more valuable, ensuring that emergency services are alerted in case of a severe incident. This system will enhance the safety of drivers and prevent accidents, particularly in older vehicles that lack these features.

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