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A Warning System for the Detection of Child in Unmoving Locked Vehcile

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ABSTRACT: *The system designed here is intended to present an efficient solution to detect the presence of a child in an infant car seat. It is a kind of warning system that alerts the parents that the child is found to be alone in a car. Infant seat with child is, usually, kept safely in the rear seat. Driver and passengers, in some situations, may leave the car without taking (forgetting) the child. When a car is turned off with closed windows, temperature inside it will increase rapidly and can be life threatening as the thermoregulatory system of child is weak. Such incidents have beeen reported world wide. To avoide such horible incidents, here this system is developed which detects the presence of a child in a locked car by detecting the voice of crycing baby and by sensing the indoor temperature of the car, and in addition to seek the help of a car sorrounded people, the public announcing system will be activated automatically to alert the near by people.*
GSM technology is used to transmit the information to the concern mobile phone, this can be done automatically when car indoor temperature raises more than 40^0C. When the temperature raises more than preset value, and when the system detects the sound of crying baby, automatically the system dials the concern mobile number and information will be passed in the form of SMS. In addition, with the help of a voice record cum play back chip interfaced with main processor designed with Arduino Uno board, the announcement in the form of "pl. help, baby is present the locked car" will be announced automatically and this announcement repeats continuously until the temperature reduces by less than 40^0C. When the temperature reduces, this indicates that some one rescued the baby by opening the car door by which announcement will be stopped automatically. Buzzer is also incorporated in the system which will be energized automatically and delivers beep sound until the baby is rescued. LCD is used to display the temperature value and APR33a3 voice record cum play back chip is used to make auto announcement.

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I. INTRODUCTION

Although many products had been invented, there are still the incidents that involve to death of children which been left in cars often occur. The system is designed in order to overcome this unwanted incident from happening. The proposed system is designed to detect sound or voice made by the children that had been left behind in a vehicle. The main target of the system is to create a complete system which uses Global System for Mobile Communication (GSM) that can communicate with human. GSM modem is the medium to interact and communicate with the module. It is used to send and receive Short Messaging System (SMS) based on which appropriate actions taken by the user. Arduino Uno board used in the project work performs as heart of whole controlling system. The system at the final stage can be used to detect the sound that had been produced by a human at optimum strength. In addition, it was also able to detect the temperature inside the car. When the car locked, naturally inside the car temperature will be raised which cannot be tolerated by the baby and therefore baby starts crying. By sensing this sound through a microphone and its audio amplifier circuit, a high signal will be fed to the Arduino board and based on this signal, the processor is programmed to transmit the information to the concern mobile phone through GSM module stating that that baby is left over in the car.

One of the most recent used in communication system in the present world of technology is Global System for Mobile Communications (GSM). It has become very popular and one of the wireless communication system that is reliable to use. In addition, it is also accessible to be used by people and very user friendly. One of the factors that make this system reliable to use is the cost effective which makes it is affordable to be owned by consumers. Nowadays, there are quite a number of cases where a baby or child had left in a car by their parents unintentional. The affected from this mistake is most of them are involved in fatal incidents because of shortage of oxygen or the intense surrounding's temperature. In addition, there are also several of incidents where thieves or robbers hiding at the back place of car seat and act to abduct children are abandoned or robbery of the vehicle owner. All of this accident had happened because of the owner's careless intention in checking for any passengers left inside before or after the vehicle have been parked. It also occurs as a result of human nature where they always forget and often think that they ride alone without bringing children together.

However, caution or carefully in all aspects should be practiced to prevent the unwanted incidents to be occurred. To avoid this kind of bad situations happens; the vehicle must be equipped or provided with a device or system that can be warned owner if there were any unwanted activities when the car owner left the vehicle. As the car was left faraway place such as parking lots or shopping mall basements, therefore there is no other way to communicate with the car except through mobile phone connectivity. Hence, the notification system needs to have access to a long-range phone communication such as GSM (Global System for Mobile Communications).

This system needed a technique on how to detect interior's voice of child that had been left in the car and then send an SMS text message to the parents alerting if any movement or voice occurs. Besides the simplicity of the proposed system, the cost will be reduced as low as possible in order to make it affordable to be installed in any kind of vehicles regardless of their quality or brands. Even though the vehicle's alarm system has been activated, but the main purpose of the alarm is to keep the car safe from outside intrusion, not inside. The proposed system will detect any change in the temperature and voice from the vehicle's interior and informed the owner by sending an SMS alert message. The proposed system will make parents more alert if they were leaving their children alone in the car and can avoid from unwanted event occurred.

1.1 GSM

GSM is known as Global System for Mobile Communication. A technology developed in 1985 by a French company known as Group Special Mobile. In fact this communication system is designed for personal communications, but today this technology has been in use for many applications. The only one technology, which doesn't have any range restriction in wireless communications, any device which is controlled or monitored can be operated anywhere from the world.Cellular radio provides mobile telephone service by employing a network of cell sites distributed over a wide range. A cell site contains a radio transceiver and a base station controller, which manages, sends, and receives traffic from the mobiles in its geographical area to a cellular phone switch. It also employs a tower and its antennas, and provides a link to the distant cellular switch called a mobile telecommunication switching office (MTSO). This MTSO places calls from land based telephones to the wireless customers, switches calls between cells as mobile travel across cell boundaries, and authenticates wireless customers before they make calls.

GSM calls are either based on data or voice. Voice calls use audio codes called half-rate, full-rate and enhanced full-rate. Data calls can turn the cell phone into a modem operating at 9600 bps. It uses digital technology and time division multiple access transmission methods. GSM technology is continually evolving, having made great leaps forward in the past 10 years. It is facing an even greater evolution in the years ahead.

In various countries the frequency bandwidths specified for the GSM services are GSM-400, GSM-800, GSM-900, GSM-1800 and GSM-R. The GSM-900 and the GSM-1800 are the most widely used frequency bandwidths in different parts of the globe. The GSM-900 has a down link frequency range of 935-960 MHz and an up link frequency of range of 895-915 MHz. This frequency band is partitioned into 124 pairs of simplex channels with separation of 200KHz.A particular range of simplex channels is given to a particular network provider.

The type of interface used in GSM is digital air interface. The analogue voice signals are converted to digital signals before transmission. Up to 8 MS the GSM RF carrier can handle subscribers at a time. The rate of transmission is 270 Kbps. The Gaussian minimum shift keying (GMSK) is used for transmitting the digital signals. In GMSK, a phase change represents the change from a digital "1" or a "0 ", occurs over a period of time. The addition of high frequency components to the spectrum is reduced. In GSMK, the phase change is not constant and it is spread- out. The GSM modem is similar to a mobile. It contains a serial port to communicate with a serial communicating device and a tray to hold the SIM card. It is having its own set of commands for sending message, receiving message, deleting message etc. These commands are sent through the microcontroller. The detailed description of this technology is provided in corresponding chapter.

II. CIRCUIT ANALYSIS

2.1 Temperature sensor

The most frequently measured environmental quantity is "Temperature" This might be expected since most of the systems are affected by temperature like physical, chemical, electronic, mechanical, and biological systems. Certain chemical effects, biological processes, and even electronic circuits execute best in limited temperature ranges. Temperature is one of the most frequently calculated variables and sensing can be made either through straight contact with the heating basis or remotely, without straight contact with the basis using radiated energy in its place. There is an ample variety of temperature sensor on the market today, including Thermocouples, Resistance Temperature Detectors (RTDs), Thermistors, Infrared, and Semiconductor Sensors.

Usually, a temperature sensor is a thermocouple or a resistance temperature detector (RTD) that gathers the temperature from a specific source and alters the collected information into understandable type for an apparatus or an observer. Temperature sensors are used in several applications. Here in this project work LM35 is used.

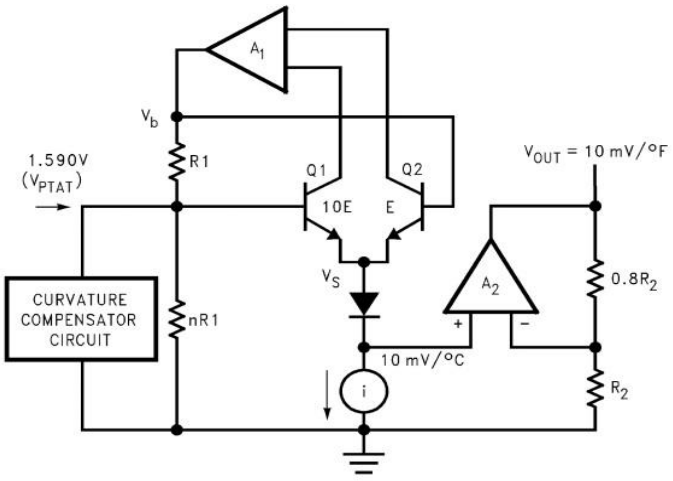
LM35 is an analog, linear temperature sensor whose output voltage varies linearly with change in temperature. LM35 is three terminal linear temperature sensors from National semiconductors. It can measure temperature from-*55* degree Celsius *to* +150 degree Celsius. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature. LM35 can be operated from a 5V supply and the stand by current is less than 60uA. LM35 is an integrated analog temperature sensor whose electrical output is proportional to Degree Centigrade. LM35 Sensor does not require any external calibration or trimming to provide typical accuracies. The LM35 temperature sensor can be used to detect precise centigrade temperature. The output of this sensor changes describes the linearity. The o/p voltage of this IC sensor is linearly comparative to the Celsius temperature.

LM35 is an analog temperature sensor. This means the output of LM35 is an analog signal. Microcontrollers don't accept analog signals as their input directly. We need to convert this analog output signal to digital before we can feed it to a microcontroller's input. For this purpose, here Arduino controller is used which is having built in with ADC (Analog to Digital Converter). Modern day boards like Arduino and most modern day micro controllers come with inbuilt ADC.

In general, a temperature sensor is a device which is designed specifically to measure the hotness or coldness of an object. LM35 is a precision IC temperature sensor with its output proportional to the temperature (in °C). With LM35, the temperature can be measured more accurately than with a thermister. It also possesses low self heating and does not cause more than 0.1 ℃ temperature rise in still air. The operating temperature range is from -55°C to 150°C. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C). It can measure temperature more accurately. The sensor circuitry is sealed and not subject to oxidation. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. The LM35 has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/°C.

The LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4°C at room temperature and +/-0.8°C over a range of 0°C to +100°C.Another important characteristic of the LM35 is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The LM35 comes in many different packages such as TO-92 plastic transistor-like package, T0-46 metal can transistor-like package, 8-lead surface mount SO-8 small outline package.



2.2 Microphone

A microphone, also known as Mic is a transducer that converts sound into an electrical signal. Microphones are used in many applications such as telephones, hearing aids, public addressing systems for concert halls and public events, motion picture production, live and recorded audio engineering, sound recording, two-way radios, megaphones, radio and TV broadcasting, and in computers for recording voice, speech recognition, and for non-acoustic purposes such as ultrasonic sensors or knock sensors. Several different types of microphone are in use, which employ different methods to convert the air pressure variations of a sound wave to an electrical signal. The most common are the dynamic microphone, which uses a coil of wire suspended in a magnetic field; the condenser microphone, which uses the vibrating diaphragm as a capacitor plate, and the piezoelectric microphone, which uses a crystal of piezoelectric material. Microphones typically need to be connected to a preamplifier before the signal can be recorded or reproduced. Here in this project work condenser microphone is used.

2.3 Pre-Amplifier

The output of this microphone is amplified using pre-amplifier circuit and it is further amplified using IC LM 386. This is an audio amplifier IC which is intended to amplify the weak audio signals generated by the pre-amplifier in to powerful audio signals. Pre-amplifier is an electronic amplifier that converts weak signals in to a strong output signal that is strong enough to drive the loud speaker. Here in our project work speaker is not required but its output is required to generate a logic high signal, means whenever the baby is crying due to the over temperature and this circuit generates logic high signal for the Arduino board. The output of amplified audio signal delivered from the IC would be noisy or distorted. Since it is AC signal, it must be converted in to DC for this purpose a diode is used at the output of audio amplifier circuit.In an audio system, pre-amplifier is typically used to amplify signal from analog sensor (preferably microphone) to the required level. The second amplifier is typically power amplifier & here low power amplifier is designed using lm386 ic. The pre-amplifier provides voltage gain, often from 10mv to 1000mv, but no significant current gain. The power amplifier provides the higher current necessary to drive speakers.

2.4 Display section

The display section is designed with LCD and the main function of this display is to display the information about the child stuck in the locked car. The LCD used here is having two rows and each row contains 16 characters, depending up on the availability of LCD panel 3 lines or 4 lines panels can be used for the purpose, so that more information can be displayed simultaneously. LCD Displays are dominating LED displays, because these displays can display alphabets, numbers and some kind of special symbols, where as LED's (seven segment display) can display only numbers. These LCD displays are very useful for displaying user information and communication. LCD displays are available in various formats.

In recent years LCD is finding widespread use replacing LED's, because of the ability to display numbers, characters, and graphics. Another advantage is, because of its compactness and ease of programming for characters and graphics, more information in the form of text message or graphics can be displayed. Generally, the LCD modules have an 8-bit interface, besides the 8-bit data bus; the interface has a few other control lines. The default data transfer between the LCD module and an external device is 8-bits, however it is possible to communicate with the LCD module using only four of the 8-data lines. The R/W line is connected to ground and hence the processor cannot read any status information from the LCD module, but can only write data to the LCD.

The LCD panel used in this project work is having 16 pins. The function of each pin description with table is as followed:

Pin No.	**Name**	**Description**
Pin no. 1	**D7**	Data bus line 7 (MSB)
Pin no. 2	**D6**	Data bus line 6
Pin no. 3	**D5**	Data bus line 5
Pin no. 4	**D4**	Data bus line 4
Pin no. 5	**D3**	Data bus line 3
Pin no. 6	**D2**	Data bus line 2
Pin no. 7	**D1**	Data bus line 1
Pin no. 8	**D0**	Data bus line 0 (LSB)
Pin no. 9	**EN1**	Enable signal for row 0 and 1 (1st controller)
Pin no. 10	**R/W**	0 = Write to LCD module 1 = Read from LCD module
Pin no. 11	**RS**	0 = Instruction inpu

		1 = Data input
Pin no. 12	**VEE**	Contrast adjust
Pin no. 13	**VSS**	Power supply (GND)
Pin no. 14	**VCC**	Power supply (+5V)
Pin no. 15	**EN2**	Enable signal for row 2 and 3 (2^{nd}controller)
Pin no. 16	**NC**	Not Connected

Vcc, Vss, and VEE: While Vcc and Vss provide +5V and ground, respectively; VEE is used for controlling LCD contrast.

RS - register select:

There are two very important registers inside the LCD. The RS pin is used for their selection as follows. If RS = 0, the instruction command code register is selected, allowing the user to send a command such as clear display, cursor at home, etc. If RS = 1 the data register is selected, allowing the user to send data to be displayed on the LCD.

R/W - read/write:

R/W input allows the user to write information to the LCD or read information from it. R/W = 1 when reading; R/W =0 when writing.

E - Enable:

The enable pin is used by the LCD to latch information presented to its data pins. When data is supplied to data pins, a high to low pulse must be applied to this pin in order for the LCD to latch in the data present at the data pins. This pulse must be a minimum of 450 ns wide.

D0 – D7: The 8 bit data pins, D0 – D7, are used to send information to the LCD or read the contents of the LCD's internal registers. To display letters and numbers, we send ASCII codes for the letters A – Z, a – z, and numbers 0 – 9 to these pins while making RS = 1. There are also instructions command codes that can be sent to the LCD to clear the display or force the cursor to the home position or blink the cursor. Table below lists the instruction command codes.

2.5 Arduino

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. This is a screenshot of the Arduino IDE. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

III. ARDUINO PROCESSOR

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are used for multiple applications in the field of electronics and communications. Arduino is a basic single board microcontroller designed to make applications, interactive controls, or environments easily adaptive. The hardware consists of a board designed around an 8-bit microcontroller, or a 32-bit ARM. Current models feature things like a USB interface, analog inputs, and GPIO pins which allows the user to attach additional boards. **GPIO** stands for General Purpose, Input, Output. All the processors we use to have at least a few, a Raspberry Pi and an **Arduino** have a lot of General Purpose Input Output that we can design our circuits.

Arduino Introduced in 2005, the Arduino platform was designed to provide a cheaper way for hobbyists, students and professionals to create applications that play in the human interface world using sensors, actuators, motors, and other elementary products. Common applications for students or the inexperienced are simple robots or motion detectors. It offers a simple integrated IDE (integrated development environment) that runs on regular personal computers and allows users to write programs for Arduino using C or C++.

Typical prices of Arduino boards run around Rs; 300/-. Arduino boards can be purchased pre-assembled or as do-it-yourself kits. Hardware design information is available for those who would like to assemble an Arduino by hand. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute, italy as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

Why Arduino?

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handy board, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50
- Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
- Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
- Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and

improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

The Unique Culture of Arduino

Some of the largest semiconductor companies have jumped into the Arduino space such as Cypress, STM, Texas Instruments, Freescale, and of course the incumbent Atmel.

What is interesting is the emergence of small cottage industries sprouting up in many unsuspected areas. This new generation of platforms is significantly different as it serves as the incubator of new designers, and a new era, as transformations of applications serve new and exciting needs.

Technical Description

Pin Description

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

Arduino Uno Technical Specifications

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 Ma
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

Other Arduino Boards

Arduino Nano, Arduino Pro Mini, Arduino Mega, Arduino Due, Arduino Leonardo

Overview

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

How to use Arduino Board

The 14 digital input/output pins can be used as input or output pins by using pin Mode (), digital Read () and digital Write () functions in Arduino programming. Each pin operate at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-50 K Ohms which are disconnected by default. Out of these 14 pins, some pins have specific functions as listed below:

- Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.
- External Interrupt Pins 2 and 3: These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analogWrite() function.
- SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK): These pins are used for SPI communication.
- In-built LED Pin 13: This pin is connected with an built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, its off.

Along with 14 Digital pins, there are 6 analog input pins, each of which provides 10 bits of resolution, i.e. 1024 different values. They measure from 0 to 5 volts but this limit can be increased by using AREF pin with analog Reference () function.

- Analog pin 4 (SDA) and pin 5 (SCA) also used for TWI communication using Wire library.

Arduino Uno has a couple of other pins as explained below:

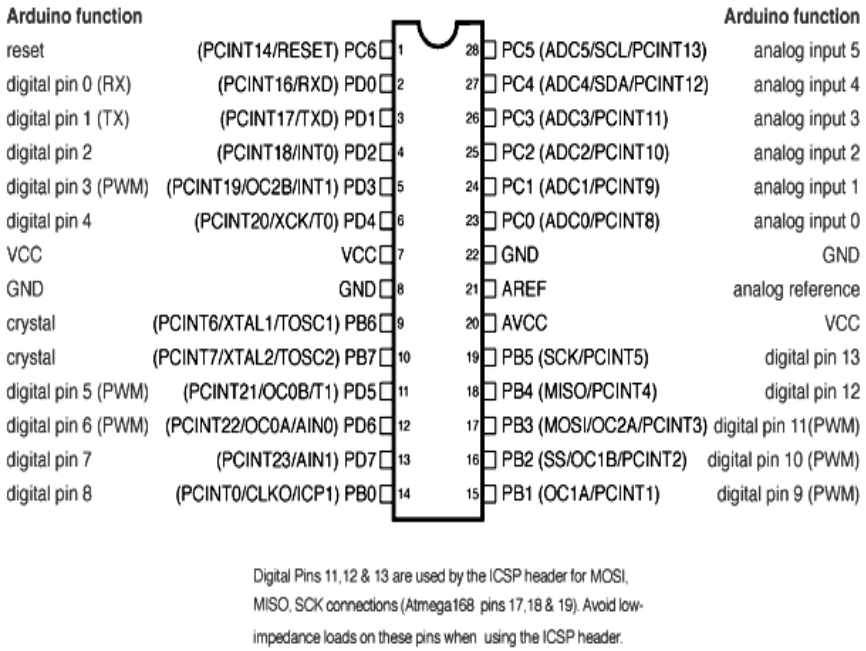
- AREF: Used to provide reference voltage for analog inputs with analogReference() function.
- Reset Pin: Making this pin LOW, resets the microcontroller.

Communication

Arduino can be used to communicate with a computer, another Arduino board or other microcontrollers. The ATmega328P microcontroller provides UART TTL (5V) serial communication which can be done using digital pin 0 (Rx) and digital pin 1 (Tx). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The ATmega16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. There are two RX and TX LEDs on the Arduino board which will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328P also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus.

Arduino Uno to ATmega328 Pin Mapping

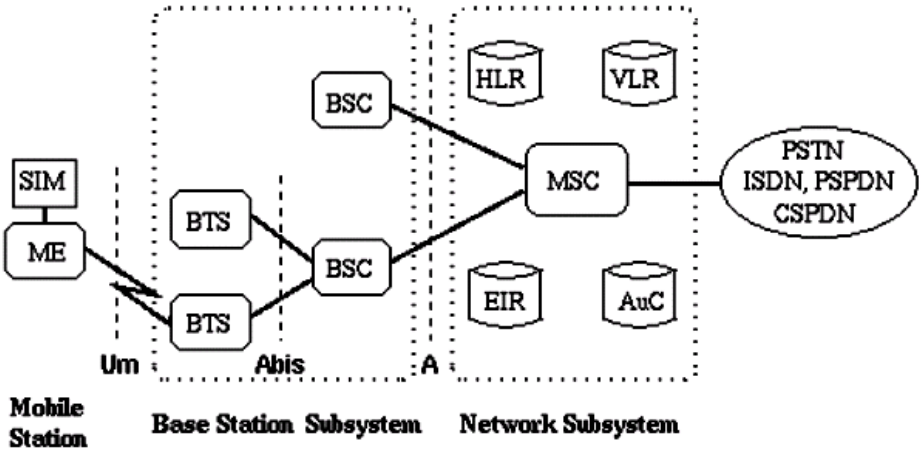
When ATmega328 chip is used in place of Arduino Uno, or vice versa, the image below shows the pin mapping between the two.



IV. ARCHITECTURE OF NETWORK

A GSM network is composed of several functional entities, whose functions and interfaces are specified. The GSM network can be divided into three broad parts. The subscriber carries the mobile station. The Base Station Subsystem controls the radio link with the mobile station. The Network Subsystem, the main part of which is the Mobile services Switching Center (MSC), performs the switching of calls between the mobile users, and between mobile and fixed network users. The MSC also handles the mobility management operations. Not shown is the Operations and Maintenance Center, which oversees the proper operation and setup of the network. The following figure shows the layout of a generic GSM net work of the Mobile Station and the Base Station Subsystem.

Not shown is the operations and Maintenance Center, which oversees the proper operation and setup of the network. The Mobile Station and the Base Station Subsystem communicate across the Un-interface, also known as the air interface or radio link. The Base Station Subsystem communicates with the Mobile services Switching Center across the A interface.



M Subscriber Identity Module
MSC Mobile services Switching Center
HLR Home Location Register
BTS Base Transceiver Station
AuC Authentication Center
BSC Base Station Controller
ME Mobile Equipment
EIR Equipment Identity Register
VLR Visitor Location Register

General Architecture of a GSM Network

Mobile Station

The mobile station (MS) consists of the mobile equipment (the terminal) and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to subscribed services irrespective of a specific terminal. By inserting the SIM card into another GSM terminal, the user is able to receive calls at that terminal, make calls from that terminal, and receive other subscribed services.

The International Mobile Equipment Identity (IMEI) uniquely identifies the mobile equipment. The SIM card contains the International Mobile Subscriber Identity (IMSI) used to identify the subscriber to the system, a secret key for authentication, and other information. The IMEI and the IMSI are independent, thereby allowing personal mobility. The SIM card may be protected against unauthorized use by a password or personal identity number.

Base Station Subsystem

The Base Station Subsystem is composed of two parts, the Base Transceiver Station (BTS) and the Base Station Controller (BSC). These communicate across the standardized Abis interface, allowing (as in the rest of the system) operation between components made by different suppliers.

The Base Transceiver Station houses the radio transceivers that define a cell and handles the radio-link protocols with the Mobile Station. In a large urban area, there will potentially be a large number of BTSs deployed, thus the requirements for a BTS are ruggedness, reliability, portability, and minimum cost.

The Base Station Controller manages the radio resources for one or more BTSs. It handles radio-channel setup, frequency hopping and handovers, as described below. The BSC is the connection between the mobile station and the Mobile service Switching Center (MSC).

Network Subsystem

The central component of the Network Subsystem is the Mobile services Switching Center (MSC). It acts like a normal switching node of the PSTN or ISDN, and additionally provides all the functionality needed to handle a mobile subscriber, such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. These services are provided in conjunction with several functional entities, which together form the Network Subsystem. The MSC provides the connection to the fixed networks (such as the PSTN or ISDN). Signaling between functional entities in the Network Subsystem uses Signaling System Number 7 (SS7), used for trunk signaling in ISDN and widely used in current public networks.

The Home Location Register (HLR) and Visitor Location Register (VLR), together with the MSC, provide the call-routing and roaming capabilities of GSM. The HLR contains all the administrative information of each subscriber registered in the corresponding GSM network, along with the current location of the mobile. The location of the mobile is typically in the form of the signaling address of the VLR associated with the mobile station. The actual routing procedure will be described later. There is logically one HLR per GSM network, although it may be implemented as a distributed database.

The Visitor Location Register (VLR) contains selected administrative information from the HLR, necessary for call control and provision of the subscribed services, for each mobile currently located in the geographical area controlled by the VLR. Although each functional entity can be implemented as an independent unit, all manufacturers of switching equipment to date implement the VLR together with the MSC, so that the geographical area controlled by the MSC corresponds to that controlled by the VLR, thus simplifying the signaling required. Note that the MSC contains no information about particular mobile stations – this information is stored in the location registers.

The other two registers are used for authentication and security purposes. The equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where its International Mobile Equipment Identity (IMEI) identifies each mobile station, An IMEL is marked as invalid if it has been reported stolen or is not type approved. The Authentication Center (AuC) is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and encryption over the radio channel.

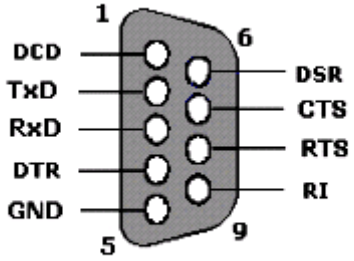
GSM Modem: GSM Modem Product, from Sparr Electronics limited (SEL), provides full functional capability to Serial devices to send SMS and Data over GSM Network. The product is available as Board Level or enclosed in Metal Box. The Board Level product can be integrated in to Various Serial devices in providing those SMS and Data capability and the unit housed in a Metal Enclosure can be kept outside to provide serial port connection. The GSM Modem supports popular "AT" command set so that users can develop applications quickly. The product has SIM cardholder to which activated SIM card is inserted for normal used. The power to this unit can be given from UPS to provide uninterrupted operation. This product provides great feasibility for Devices in remote location to stay connected which otherwise would not have been possible where telephone lines do not exist.

Application Areas

- Mobile Transport vehicles.
- LAN based SMS servers
- Alarm notification of critical events including Servers
- Network Monitoring and SMS reporting
- Data Transfer applications from remote locations
- Monitor and control of Serial services through GSM Network
- Integration to custom software for Warehouse, Stock, Production, Dispatch notification through SMS

Serial Pin out (D-9 Connector)

Serial Port D-type 9 pin connector, which is male on the back of the GSM modem, thus you will require a female connector on your device. Below is a table of pin connections for the 9 Pin D-type



9- Pin female connector

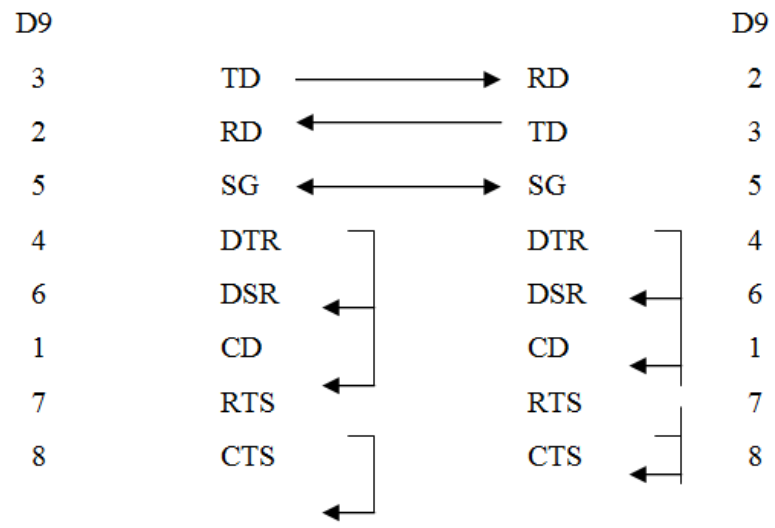
Pin No.	Abbreviation	Full Name
Pin 3	TD	Transmit Data
Pin 2	RD	Receive Data
Pin 7	RTS	Request To Send
Pin 8	CTS	Clear To Send
Pin 6	DSR	Data Set Ready
Pin 5	SG	Signal Ground
Pin 1	CD	Carrier Detect
Pin 4	DTR	Data Terminal Ready
Pin 5	RI	Ring Indication

Pin Functions

Abbreviation	**Full Name**	**Function**
TD	Transmit Data	Serial Data Output (TXD)
RD	Receive Data	Serial Data Input (RXD)
CTS	Clear to Send	This line indicates that the Modem is ready to exchange data.
DCD	Data Carrier Detect	When the modem detects a "Carrier" from the modem at the other end of the phone line, this line becomes active.
DSR	Data Set Ready	This tells the UART that the modem is ready to establish a link.
DTR	Data Terminal Ready	This is the opposite to DSR. This tells the modem that the UART is ready to link.
RTS	Request To Send	This line informs the Modem that the UART is ready to exchange data.
RI	Ring Indicator	Goes active when modem detects a ringing signal from the PSTN.

NULL Modems

A Null Modem is used to connect two DTES together. This is commonly used as a cheap way to network games or to transfer files between computers using Z modem protocol, X modem Protocol etc. This can also be used with many Microprocessor Development Systems.



Null Modem Wiring Diagram

Above is my preferred method of wiring a Null Modem. It only requires 3 wires (TD, RD & SG) to be wired straight through thus is more cost effective to use with long cable runs. The theory of operation is reasonably easy. The aim is to make to computer it is talking to a modem rather than another computer. Any data transmitted from the first computer must be received by the second thus TD is connected to RD. the second computer must have the same set-up thus RD is connected to TD. Signal Ground (SG) must also be connected so both grounds are common to each computer.

The Data Terminal Ready is looped back to Data Set Ready and Carrier Detect on both computers. When the Data Terminal Ready is asserted active, then the Data Set Ready and Carrier Detect immediately become active. At this point the computer thinks the Virtual Modem to which is connected is ready and has detected the carrier of the other modem. All left to worry about now is the Request to Send and Clear to Send. As both computers communicate together at the same speed, flow control is not needed thus these two lines are also linked together on each computer. When the computer wishes to send data, it asserts the Request to Send high and as it's hooked together with the Clear to Send, it immediately gets a reply that it is ok to send and does so.

SEND MESSAGE +CMGS

Description:

The <address> field is the address of the terminal to which the message is sent. To send the message, simply type, <ctrl-z> character (ACII 26). The text can contain all existing characters except <ctrl-z> and <ESC> (ASCII 27). This command can be aborted using the <ESC> character when entering text. In PDU mode, only hexadecimal characters are used ('0'…'9','A'…'F').

Syntax:

Command syntax in text mode:

AT+CMGS= <da> [,<toda>] <CR> text is entered <ctrl-z / ESC >

Command syntax in PDU mode:

AT+CMGS= <length> <CR> PDU is entered <ctrl-z / ESC >

Command	Possible response
AT+CMGS="+33146290800" <CR> Please call me soon fred. <ctrl.z> Note: send a message in text mode.	+CMGS;<mr> OK Note: successful transmission
AT+CMGS+<length><CR><pdu><ctrlz> Note: Send a message ij pdu mode	+CMGS;<mr> OK Note: successful transmission

V. LCD INTERFACING ARDUINO

In Arduino based embedded system design, the Liquid Crystal Display modules play a very important role. Hence it is very important to learn about how to interface LCD with an Arduino of 16×2 in embedded system design. The display units are very important in communication between the human world and the machine world. The display unit work on the same principle, it does not depend on the size of the display it may be big or the small. We are working with the simple displays like 16×1 and 16×2 units. The 16×1 display unit has the 16 characters which present in one line and 16×2 display units have 32 characters which are present in

the 2 line. We should know that to display the each character there are 5×10 pixels. Thus to display one character all the 50 pixels should be together. In the display, there is a controller Built in with panel which is HD44780 it is used to control the pixels of characters to display.

What is a Liquid Crystal Display?

The liquid crystal display uses the property of light monitoring of liquid crystal and they do not emit the light directly. The Liquid crystal display is a flat panel display or the electronic visual display. With low information, content the LCD' s are obtained in the fixed image or the arbitrary image which are displayed or hidden like present words, digits, or 7 segment display. The arbitrary images are made up of large no of small pixels and the element has larger elements.

Liquid Crystal Display of 16×2

The 16×2 liquid crystal display contains two horizontal lines and they are used for compressing the space of 16 display characters. In inbuilt, the LCD has two registers which are described below.

- Command Register
- Data Register

Command Register: This register is used to insert a special command in the LCD. The command is a special set of data and it is used to give the internal command to the liquid crystal display like clear screen, move to line 1 character 1, setting the curser and etc.

Data Register: The data registers are used to enter the line in the LCD

Pin No	Pin Name	Pin Description
Pin 1	GND	This pin is a ground pin and the LCD is connected to the Ground
Pin 2	VCC	The VCC pin is used to supply the power to the LCD
Pin 3	VEE	This pin is used for adjusting the contrast of the LCD by connecting the variable resistor in between th VCC & Ground.
Pin 4	RS	The RS is known as register select and it selects the Command/Data register. To select the comman register the RS should be equal to zero. To select the Data register the RS should be equal to one.
Pin 5	R/W	This pin is used to select the operations of Read/Write. To perform the write operations the R/W shoul be equal to zero. To perform the read operations the R/W should be equal to one.
Pin 6	EN	This is a enable signal pin if the positive pulses are passing through a pin, then the pin function as read/write pin.
Pin 7	DB0 to DB7	The pin 7 contains total 8 pins which are used as a Data pin of LCD.
Pin 15	LED +	This pin is connected to VCC and it is used for the pin 16 to set up the glow of backlight of LCD.
Pin 16	LED –	This pin is connected to Ground and it is used for the pin 15 to set up the glow of backlight of the LCD

LCD Interfacing with the Arduino Module

The RS pin of the LCD can be connected to any digital pin of Arduino processor and the program must be prepared according to the pin numbers. The LCD of R/W pin is connected to the ground. The LCD module & Arduino module are interfaced with the 4-bit mode in this project. Hence there are four input lines which are DB4 to DB7 of the LCD. This process very simple, it requires fewer connection cables and also we can utilize the most potential of the LCD module.

LCD Interfacing with the Arduino Module

The digital input lines (DB4-DB7) are interfaced with the Arduino pins from 2-5. To adjust the contrast of the display here we can use 1K potentiometer. The current through the back LED light is fed through 100-ohm resistor. The external power source of +5V is fed to the pin 2 of LCD and Arduino board is powered through 9V regulator. The Arduino board is built in with internal regulator of 5v such that input supply source to this board must be around 9v.

In recent years the LCD panels became very popular because of their widespread use in various electronic systems like instruments to read the parameter values, digital communications for sending or receiving the text information, data acquisition systems, etc. These display units dominating seven segment displays by providing more features to the user. The LCD system can display numbers, characters, and graphics, where as seven segments LED's displays only numbers, there fore most of the engineers prefers LCD's. The data fed to the LCD remains as it is and the same will be displayed until it gets an erase signal from the controller. The data can be stored and it can be refreshed for the next task.

The instruction command codes from microcontroller can be sent to the LCD to clear the display, depending up on the command the cursor can be brought to home position or blink the cursor. The LCD is having two important resistors internally, command resistor and data register; RS pin is used to select either

command register or data register. If RS = 0, the instruction command code register is selected and allowing the user to send a command to clear the display. If RS = 1 the data register is selected, there by the user is allowed to send data that is to be displayed on LCD screen. By making RS pin to zero, we can also check the busy flag bit to see if the LCD is ready to receive information. As already mentioned that D0 – D7 of LCD pins are 8 – bit data pins and the busy flag is D7, it can be read when R/W (Read or Write) pin is high (R/W = 0) and RS = 0, as follows; if R/W = 1, R/S = 1. When D7 pin is high, the LCD is busy taking care of internal operations and will not accept any new information. When D7 = 0, the LCD is ready to receive new information. It is recommended to check the busy flag before writing any data to the LCD. The following is the table shows the list of instruction command codes.

Code	Command to LCD Instruction
1	Clear display screen
2	Return home
4	Decrement cursor (shift cursor to left)
6	Increment cursor (shift cursor to right)
5	Shift display right
7	Shift display left
8	Display off, cursor off
A	Display off, cursor on
C	Display on, cursor off
E	Display on, cursor blinking
F	Display on, cursor blinking
10	Shift cursor position to left
14	Shift cursor position to right
18	Shift the entire display to the left
IC	Shift the entire display to the right
80	Force cursor to beginning of first line
CO	Force cursor to beginning of second line
38	2 Lines and 5x7 Matrix

To send any commands from instruction command code table to the LCD, make RS pin to zero. For data, feed high signal to RS pin, then send a high – to – low pulse to the E pin to enable the internal latch of the LCD. For this, the suitable program is to be prepared for LCD connections. Another suitable program is to be prepared for sending code to the LCD with checking busy flag. Depending up on the program the busy flag can be D7 of the command resistor, to read command register R/W pin must be high and RS pin must be low, and a low to high pulse for the enable pin will provide the command register. After reading the command register, if bit D7 (busy flag) is high, the LCD is busy and no information (either command or data) should be issued to it. During D7 is zero; at that time we can send data or commands to the LCD. In this method time delays are not required in the program, because we are checking the busy flag before issuing commands to the LCD. Enable line must be negative-edge triggered for the write and it should be positive-edge triggered for the read.

VI. HARDWARE DETAILS AND CONCLUSION

To prove any project work practically for the demonstration purpose, construction of described model is essential. For this purpose suitable hardware in the form of electronic, electrical and mechanical components are essential to perform the given task. When these components are integrated together or working together, better results can be obtained from the project work. Since it is a practical oriented project work, the content presented in the abstract must be proven practically. In this regard required active hardware like IC's, sensors and other special components must be gathered and their details must be described in this chapter to fulfill the concept of perfect project report.

Electronic hardware is Hardware, in the context of technology, refers to the physical elements that make up electronic system or electro-mechanical system, and everything else involved that is physically touchable. When an embedded system is considered, that contains a processing unit (Often microcontroller chips are preferred to build a processing unit) Sensors, control circuits that includes the motors, relays, switching devices (like power Mosfets, transistors, etc). Hardware works hand-in-hand with firmware and software to make a system function. Software is a collection of code installed into the microcontroller chip. Often LCD displays are used to monitor the system performance or results. But here in this project work LCD is not required the function of embedded system used here is very simple which is aimed to control the shocking weapon and voice chip.

When computer is considered as example, Hardware is only one part of a computer system, but there is also firmware, which is embedded into the hardware and directly controls it. There is also software, which runs

on top of the hardware and makes use of the firmware to interface with the hardware. Hardware is a surrounding term that refers to all the physical parts that make up a computer. The internal hardware devices that make up the computer and ensure that it is functional are called components, while external hardware devices that are not essential to a computer's functions are called peripherals.

The following are the active components used in this project work.
1 – IC LM386
2 – APR33A3 Voice record cum playback chip
3 – LM324
4 – Voltage regulator
5 – Microphone
6 – Speaker
7 – LCD
8 – Relay
9 – Buzzer
10 – LM Temperature sensor

The project work "A warning system for detection of the child in unmoving locked vehicle" is designed and developed successfully. For the demonstration purpose a prototype module is constructed with GSM module, results are found to be satisfactory.

As a conclusion to the system, it can be used to detect the sound that is been produced by the baby, based on this signal, and in addition based on the raise in temperature inside the car, the system is programmed to perform 3 important functions like raise the alarm to alert the nearby people, send the message to the concern persons through GSM module and announce the situation through voice record cum playback chip. These are the tree important activities are included in the system, if required additional features like, detecting the motion using PIR (Passive Infra Red) sensor also known as motion sensor can be included by which movements of baby can be recognized. This feature will be added in our future work.

If there is any noise that generated from outside the car, the voice sensor cannot detect the sound that been produced. As if the car door closed tightly, any noise that generated from outside will not be able to detect. In addition, this system also uses Global System Communication (GSM), where it can be used to communicate with people even at great distances. If the sensor is placed in the car managed to detect sound or movement that made by a child who was left in the car, it will continue to work and sending message to the parents to alert them that their child was left in the car.

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