# ABSTRACT

Smart phone application gives services and assists the elderly person to complete their daily life activities as others. This application Patients need not remember their medicine dosage timings as they can set their dosage timings. Voice based Remainder notification alert can be set for multiple medicines and timings including date, time and medicine description, this application will remind their user about the medicine in-take schedule. This mobile application integrates with multiple color button option. Whenever elder people need some service, they can click on the emergency color button. Based on color pattern action will be performed. For example, if user click red button “Mobile going to switch off” this message automatically sends to register member’s mobile number. By pressing the color button based on color this mobile application automatically sends the location information, location image, service message to particular register mobile number and mail id. It is quite possible you can communicate effectively to explain your position to family members. This helps us to identify the protect and call on resources to help the one out of dangerous situations. This application is having both safety and security.

It is a common observation that people prioritize their work and other material possessions before caring for their health. Patients can access smart phone software (or "apps") made to make it easier for them to remember to take their medications, but a notification will be sent when it's time to take medicine, by the available reminder system and not to remember medication schedules or keep track of medication data for the caregiver. the proposed smart pill box is programmable, allowing medical staff or patients to specify the dosage and timing of medications that are prescribed by the medical practitioner, as well as the medication hours that can be decided by the caregiver for each day.

This is a portable Android-based programmed aid box that includes a way to set up alarms automatically. With the option to set an alarm, this system eliminates the need for users to remember when to take their medications. Still, other schedules and prescriptions, including dates, times, messages, and medications, can be set as alarms.

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# 1.1,INTRODUCTION TO EMBEDDED SYSTEMS

Many embedded systems have substantially different design constraints than desktop computing applications. No single characterization applies to the diverse spectrum of embedded systems. However, some combination of cost pressure, long life-cycle, real¬- time requirements, reliability requirements, and design culture dysfunction can make it difficult to be successful applying traditional computer design methodologies and tools to embedded applications. Embedded systems in many cases must be optimized for life-cycle and business-driven factors rather than for maximum computing throughput. There is currently little tool support for expanding embedded computer design to the scope of holistic embedded system design. However, knowing the strengths and weaknesses of current approaches can set expectations appropriately, identify risk areas to tool adopters, and suggest ways in which tool builders can meet industrial needs. If we look around us, today we see numerous appliances which we use daily, be it our refrigerator, the microwave oven, cars, PDAs etc. Most appliances today are powered by something beneath the sheath that makes them do what they do. These are tiny microprocessors, which respond to various keystrokes or inputs. These tiny microprocessors, working on basic assembly languages, are the heart of the appliances. We call them embedded systems. Of all the semiconductor industries, the embedded systems market place is the most conservative, and engineering decisions here usually lean towards established, low risk solutions. Welcome to the world of embedded systems, of computers that will not look like computers and won’t function like anything we are familiar with.

## CLASSIFICATION

Embedded systems are divided into autonomous, realtime, networked & mobile categories.

Autonomous systems

They function in standalone mode. Many embedded systems used for process control in manufacturing units& automobiles fall under this category.

Real-time embedded systems

These are required to carry out specific tasks in a specified amount of time.

These systems are extensively used to carry out time critical tasks in process control. Networked embedded systems

They monitor plant parameters such as temperature, pressure and humidity and send the data over the network to a centralized system for on line monitoring.

### Mobile gadgets

Mobile gadgets need to store databases locally in their memory. These gadgets imbibe powerful computing & communication capabilities to perform real time as well as non real time tasks and handle multimedia applications. The embedded system is a combination of computer hardware, software, firmware and perhaps additional mechanical parts, designed to perform a specific function. A good example is an automatic washing machine or a microwave oven. Such a system is in direct contrast to a personal computer, which is not designed to do only a specific task. But an embedded system is designed to do a specific task with in a given time frame, repeatedly, endlessly, with or without human interaction.

### Hardware

Good software design in embedded systems stems from a good understanding of the hardware behind it. All embedded systems need a microprocessor, and the kinds of microprocessors used in them are quite varied. A list of some of the common microprocessors families are: ARM family, The Zilog Z8 family, Intel 8051/X86 family, Motorola 68K family and the power PC family. For processing of information and execution of programs, embedded system incorporates microprocessor or micro- controller. In an embedded system the microprocessor is a part of final product and is not available for reprogramming to the end user. An embedded system also needs memory for two purposes, to store its program and to store its data. Unlike normal desktops in which data and programs are stored at the same place, embedded systems store data and programs in different memories. This is simply because the embedded system does not have a hard drive and the program must be stored in memory even when the power is turned off. This type of memory is called ROM. Embedded applications commonly employ a special type of ROM that can be programmed or reprogrammed with the help of special devices.

## OTHER COMMON PARTS FOUND ON MANY EMBEDDED SYSTEMS

* UART& RS232
* PLD
* ASIC’s& FPGA’s
* Watch dog timer etc.

## DESIGN PROCESS

Embedded system design is a quantitative job. The pillars of the system design methodology are the separation between function and architecture, is an essential step from conception to implementation. In recent past, the search and industrial community has paid significant attention to the topic of hardware-software (HW/SW) co design and has tackled the problem of coordinating the design of the parts to be implemented as software and the parts to be implemented as hardware avoiding the HW/SW integration problem marred the electronics system industry so long. In any large scale embedded systems design methodology, concurrency must be considered as a first class citizen at all levels of abstraction and in both hardware and software. Formal models & transformations in system design are used so that verification and synthesis can be applied to advantage in the design methodology. Simulation tools are used for exploring the design space for validating the functional and timing behaviors of embedded systems. Hardware can be simulated at different levels such as electrical circuits, logic gates, RTL

e.t.c. using VHDL description. In some environments software development tools can be coupled with hardware simulators, while in others the software is executed on the simulated hardware. The later approach is feasible only for small parts of embedded systems. Design of an embedded system using Intel’s 80C188EB chip is shown in the figure. In order to reduce complexity, the design process is divided in four major steps: specification, system synthesis, implementation synthesis and performance evaluation of the prototype.

## SPECIFICATION

During this part of the design process, the informal requirements of the analysis are transformed to formal specification using SDL.

## SYSTEM-SYNTHESIS

For performing an automatic HW/SW partitioning, the system synthesis step translates the SDL specification to an internal system model switch contains problem graph& architecture graph. After system synthesis, the resulting system model is translated back to SDL.

## IMPLEMENTATION-SYNTHESIS

SDL specification is then translated into conventional implementation languages such as VHDL for hardware modules and C for software parts of the system

## PROTOTYPING

On a prototyping platform, the implementation of the system under development is executed with the software parts running on multiprocessor unit and the hardware part running on a FPGA board known as phoenix, prototype hardware for Embedded Network Interconnect Accelerators.

## APPLICATIONS

Embedded systems are finding their way into robotic toys and electronic pets, intelligent cars and remote controllable home appliances. All the major toy makers across the world have been coming out with advanced interactive toys that can become our friends for life. ‘Furby’ and ‘AIBO’ are good examples at this kind. Furbies have a distinct life cycle just like human beings, starting from being a baby and growing to an adult one. In AIBO first two letters stands for Artificial Intelligence. Next two letters represents robot. The AIBO is robotic dog. Embedded systems in cars also known as Telematics Systems are used to provide navigational security communication & entertainment services using GPS, satellite. Home appliances are going the embedded way. LG electronics digital DIOS refrigerator can be used for surfing the net, checking e-mail, making video phone

calls and watching TV.IBM is developing an air conditioner that we can control over the net. Embedded systems cover such a broad range of products that generalization is difficult. Here are some broad categories

* + - * Aerospace and defence electronics: Fire control, radar, robotics/sensors, sonar.
      * Automotive: Autobody electronics, auto power train, auto safety, car information systems.
      * Broadcast & entertainment: Analog and digital sound products, cameras, DVDs, Set top boxes, virtual reality systems, graphic products.
      * Consumer/internet appliances: Business handheld computers, business network computers/terminals, electronic books, internet smart handheld devices, PDAs.
      * Data communications: Analog modems, ATM switches, cable modems, XDSL modems, Ethernet switches, concentrators.
      * Digital imaging: Copiers, digital still cameras, Fax machines, printers, scanners.
      * Industrial measurement and control: Hydro electric utility research & management traffic management systems, train marine vessel management systems.
      * Medical electronics: Diagnostic devices, real time medical imaging systems, surgical devices, critical care systems.
      * Server I/O: Embedded servers, enterprise PC servers, PCI LAN/NIC controllers, RAID devices, SCSI devices.
      * Telecommunications: ATM communication products, base stations, networking switches, SONET/SDH cross connect, multiplexer.
      * Mobile data infrastructures: Mobile data terminals, pagers, VSATs, Wireless LANs, Wireless phones.

## LITERATURE SURVEY:

The integration of voice recognition and Internet of Things (IoT) technologies into medication management systems has garnered significant attention in recent years. This literature survey reviews key developments, methodologies, and findings in the field of voice-based portable medication systems, highlighting their potential to improve medication adherence and patient outcomes.

#### Voice Recognition in Health care:

Voice recognition technology has been widely explored for various health care applications, particularly for improving accessibility and ease of use for elderly patients and individuals with disabilities. Research indicates that voice-controlled systems can enhance patient interaction with health care devices, reducing the need for manual input and simplifying complex processes**.**

**Kim et al. (2019)** examined the use of voice recognition technology in healthcare, highlighting its potential to streamline patient interactions and improve the management of chronic diseases. The study emphasized the importance of high accuracy and reliability in voice recognition to ensure effective communication between patients and healthcare devices .

**Hossain et al. (2020)** developed a voice-controlled medication assistant specifically designed for elderly patients. The system demonstrated significant improvements in user satisfaction and adherence rates, underlining the benefits of voice interfaces in simplifying medication management .

#### IoT-Based Medication Systems

IoT technology enables the creation of smart medication systems that can monitor and manage medication adherence in real-time. These systems often include features such as automated reminders, remote monitoring, and data analytics.

**Kumar et al. (2018)** proposed an IoT-based smart health monitoring system that includes medication management functionalities. The system utilizes sensors and connectivity

modules to track medication intake and provide real-time updates to healthcare providers, enhancing patient monitoring and intervention capabilities .

**MedMinder’s Maya** and **Pillo Health** are commercial examples of IoT-enabled medication dispensers that leverage voice prompts and reminders to assist users with their medication schedules. These systems have been successful in improving adherence rates and providing peace of mind for both patients and caregivers .

#### Integrated Voice and IoT Systems for Medication Management

Combining voice recognition and IoT technologies in a single system offers a comprehensive solution for medication management, providing both ease of use and advanced monitoring capabilities.

**Aboobakar et al. (2019)** designed a smart medication dispenser that integrates voice recognition and IoT functionalities. The system was able to accurately dispense medication and remind users of their schedules through voice prompts. The study reported high user satisfaction and improved adherence rates, demonstrating the effectiveness of integrating these technologies .

**US Patent No. US10195011B2** describes a medication dispensing system that incorporates voice recognition to assist users in managing their medication schedules. The patented system highlights the potential of voice-controlled interfaces to improve the usability and accessibility of medication dispensers .

#### Challenges and Considerations

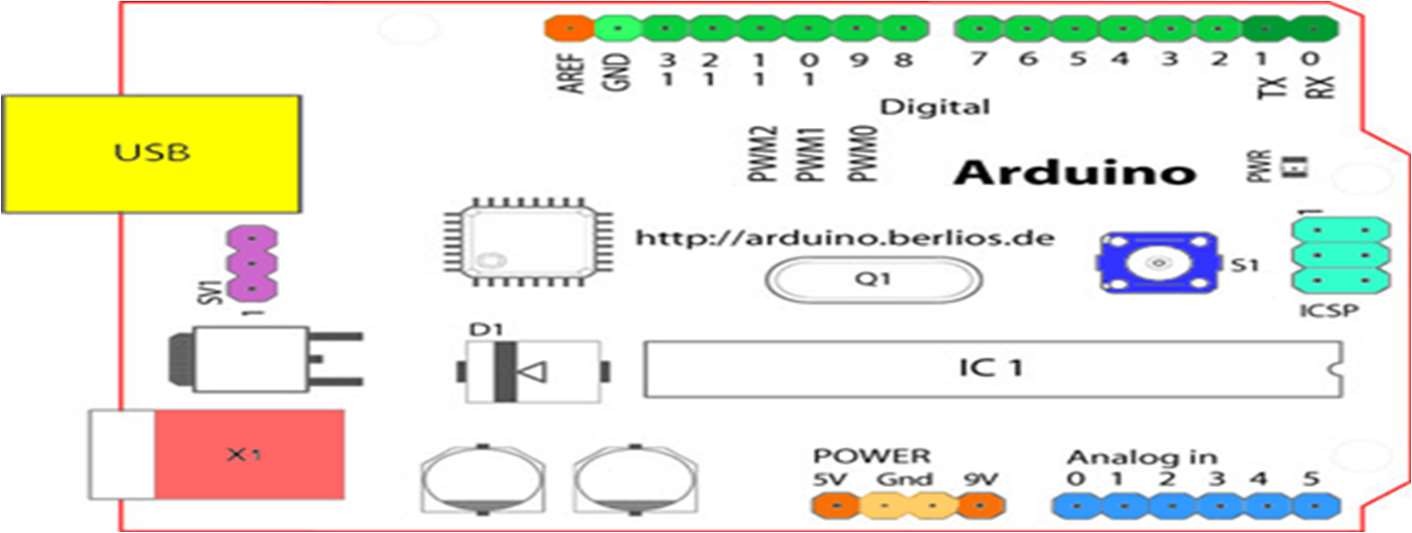
While voice-based portable medication systems offer numerous benefits, several challenges need to be addressed to ensure their effectiveness and widespread adoption.

**ARUDINO:**

# THEORY:

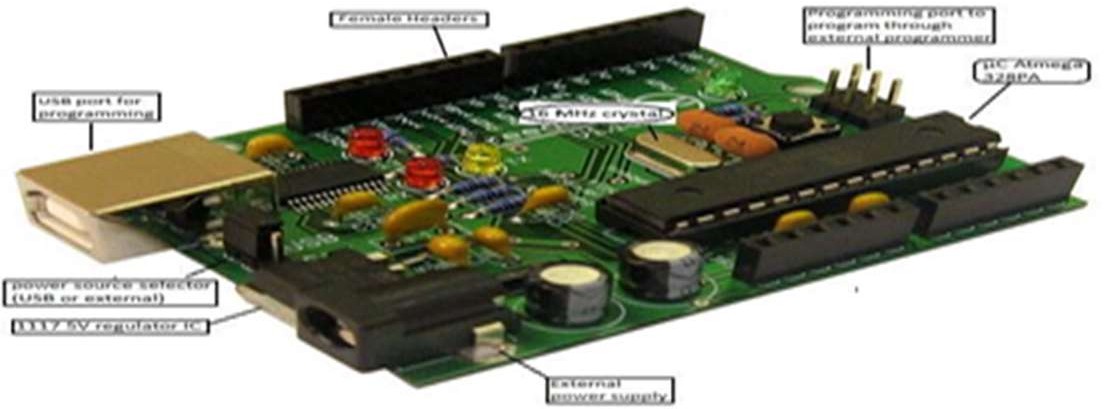
The Arduino is a family of microcontroller boards to simplify electronic design, prototyping and experimenting for artists, hackers, hobbyists, but also many professionals. People use it as brains for their robots, to build new digital music instruments, or to build a system that lets your house plants tweet you when they’re dry. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller — essentially a complete computer with CPU, RAM, Flash memory, and input/output pins, all on a single chip. Unlike, say, a Raspberry Pi, it’s designed to attach all kinds of sensors, LEDs, small motors and speakers, servos, etc. directly to these pins, which can read in or output digital or analog voltages between 0 and 5 volts. The Arduino connects to your computer via USB, where you program it in a simple language (C/C++, similar to Java) from inside the free Arduino IDE by uploading your compiled code to the board. Once programmed, the Arduino can run with the USB link back to your computer, or stand-alone without it — no keyboard or screen needed, just power.

#### Figure 3.1. Structure of Arduino Board



Looking at the board from the top down, this is an outline of what you will see (parts of the board you might interact with in the course of normal use are highlighted)

Figure 3.2. Arduino Board



Starting clockwise from the top center:

* + Analog Reference pin (orange)
  + Digital Ground (light green)
  + Digital Pins 2-13 (green)
  + Digital Pins 0-1/Serial In/Out - TX/RX (dark green) - These pins cannot be used for digital i/o (Digital Read and Digital Write) if you are also using serial communication (e.g. Serial.begin).
  + Reset Button - S1 (dark blue)
  + In-circuit Serial Programmer (blue-green)
  + Analog In Pins 0-5 (light blue)
  + Power and Ground Pins (power: orange, grounds: light orange)
  + External Power Supply In (9-12VDC) - X1 (pink)
  + Toggles External Power and USB Power (place jumper on two pins closest to desired supply) - SV1 (purple)
  + USB (used for uploading sketches to the board and for serial communication between the board and the computer; can be used to power the board) (yellow)

## DIGITAL PINS

In addition to the specific functions listed below, the digital pins on an Arduino board can be used for general purpose input and output via the pin Mode(), Digital Read(), and Digital Write() commands. Each pin has an internal pull-up resistor which can be turned on and off using digital Write() (w/ a value of HIGH or LOW, respectively) when the pin is configured as an input. The maximum current per pin is 40mA.

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. On the Arduino Diecimila, these pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip. On the Arduino BT, they are connected to the corresponding pins of the WT11 Bluetooth module. On the Arduino Mini and LilyPad Arduino, they are intended for use with an external TTL serial module (e.g. the Mini-USB Adapter).

External Interrupts: 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. See the attach Interrupt() function for details.

PWM: 3, 5, 6, 9, 10, and 11 Provide 8-bit PWM output with the analog Write() function. On boards with an ATmega8, PWM output is available only on pins 9, 10, and 11.

* BT Reset: 7. (Arduino BT-only) Connected to the reset line of the bluetooth module.
* SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI

communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

* LED: 13. On the Diecimila and LilyPad, there is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

#### ANALOG PINS

In addition to the specific functions listed below, the analog input pins support 10-bit analog-to-digital conversion (ADC) using the analog Read() function. Most of the analog inputs can also be used as digital pins: analog input 0 as digital pin 14 through analog input

5 as digital pin 19. Analog inputs 6 and 7 (present on the Mini and BT) cannot be used as digital pins.

* I2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the Wire library (documentation on the Wiring website).

## POWER PINS

* VIN (sometimes labeled "9V"): The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin. Also note that the Lily Pad has no VIN pin and accepts only a regulated input.
* 5V: The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
* 3V3 (Diecimila-only) : A 3.3 volt supply generated by the on-board FTDI chip.
* GND: Ground pins.

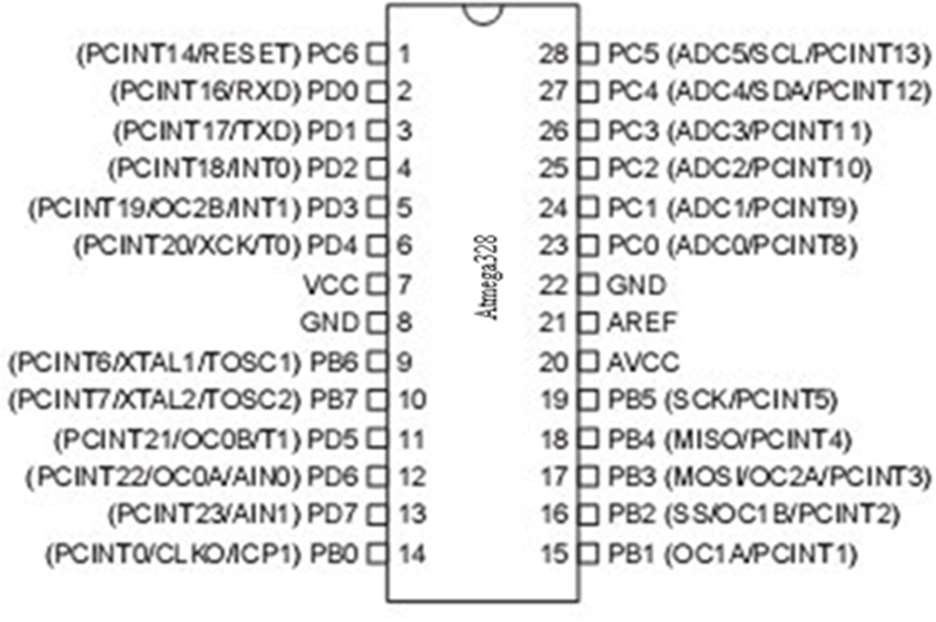
## OTHER PINS

* AREF: Reference voltage for the analog inputs. Used with analog Reference().
* Reset: (Diecimila-only) Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

ATMEGA328

Pin diagram

Figure 3.3Pin Configuration of Atmega328



Pin Description VCC:

Digital supply voltage.

GND:

Ground.

Port A (PA7-PA0):

Port A serves as the analog inputs to the A/D Converter. Port A also serves as an 8- bit bi-directional I/O port, if the A/D Converter is not used. Port pins can provide internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. When pins PA0 to PA7 are used as inputs and are externally pulled low, they will source current if the internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B (PB7-PB0):

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high

sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running. Port B also serves the functions of various special features of the ATmega32.

Port C (PC7-PC0):

Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pins PC5(TDI), PC3(TMS) and PC2(TCK) will be activated even if a reset occurs. The TD0 pin is tri-stated unless TAP states that shift out data are entered. Port C also serves the functions of the JTAG interface.

Port D (PD7-PD0):

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running. Port D also serves the functions of various special features of the ATmega32.

Reset (Reset Input):

A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.

XTAL1:

Input to the inverting Oscillator amplifier and input to the internal clock operating

circuit.

XTAL2:

Output from the inverting Oscillator amplifier.

AVCC:

AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

AREF:

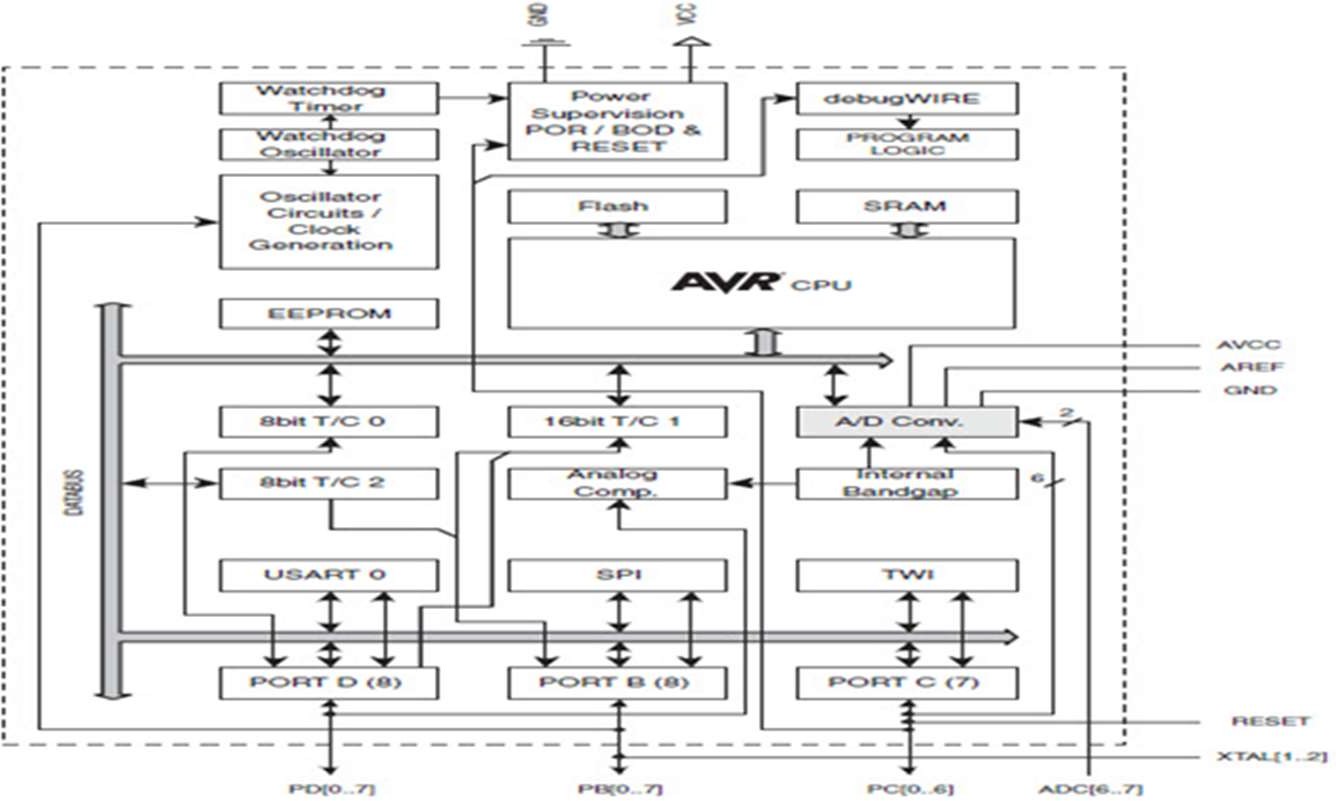
AREF is the analog reference pin for the A/D Converter.

## FEATURES

* ◻ 1.8-5.5V operating range
* ◻ Up to 20MHz
* ◻ Part: ATMEGA328P-AU
* ◻ 32kB Flash program memory
* ◻ 1kB EEPROM
* ◻ 2kB Internal SRAM
* ◻ 2 8-bit Timer/Counters
* ◻ 16-bit Timer/Counter
* ◻ RTC with separate oscillator
* ◻ 6 PWM Channels
* ◻ 8 Channel 10-bit ADC
* ◻ Serial USART
* ◻ Master/Slave SPI interface
* ◻ 2-wire (I2C) interface
* ◻ Watchdog timer
* ◻ Analog comparator
* ◻ 23 IO lines
* ◻ Data retention: 20 years at 85C/ 100 years at 25C
* ◻ Digital I/O Pins are 14 (out of which 6 provide PWM output)
* ◻ Analog Input Pins are 6.
* ◻ DC Current per I/O is 40 mA
* ◻ DC Current for 3.3V Pin is 50mA AVR CPU CORE

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

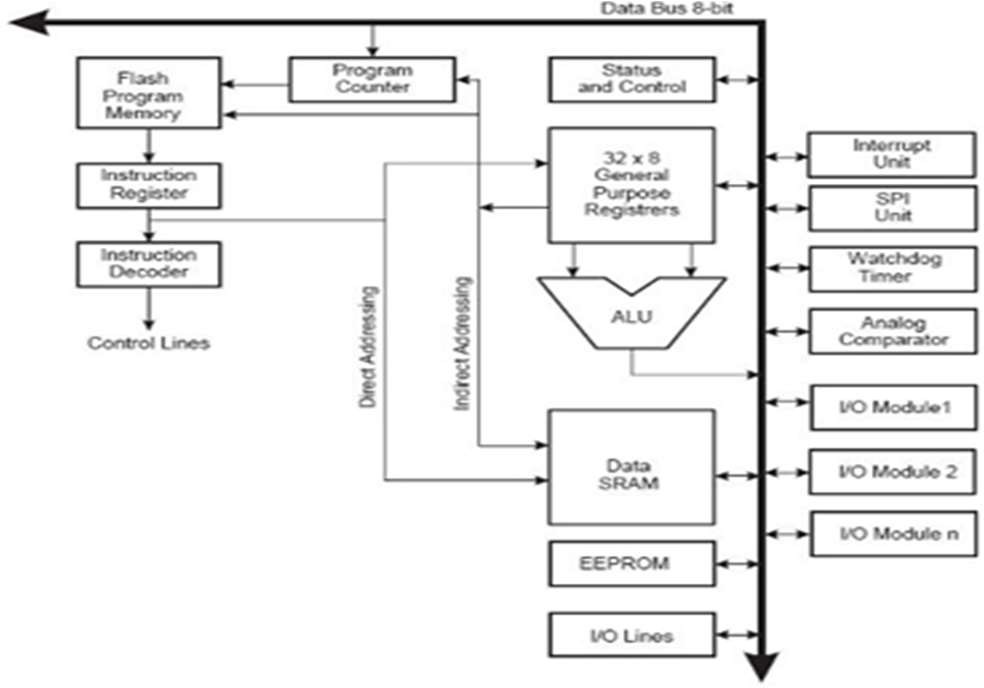
Figure 3.4 Block Diagram



OVERVIEW

This section discusses the AVR core architecture in general. The main function of the CPU core is to ensure correct program execution. The CPU must therefore be able to access memories, perform calculations, control peripherals, and handle interrupts.

3.5Figure AVR core architecture



In order to maximize performance and parallelism, the AVR uses a Harvard architecture – with separate memories and buses for program and data. Instructions in the program memory are executed with a single level pipelining. While one instruction is being executed, the next instruction is pre-fetched from the program memory. This concept enables instructions to be executed in every clock cycle. The program memory is In- System Reprogrammable Flash memory. The fast-access Register File contains 32 x 8-bit general purpose working registers with a single clock cycle access time. This allows single-cycle Arithmetic Logic Unit (ALU) operation. In a typical ALU operation, two operands are output from the Register File, the operation is executed, and the result is stored back in the Register File– in one clock cycle.

Six of the 32 registers can be used as three 16-bit indirect address register pointers for Data Space addressing – enabling efficient address calculations. One of these address pointers can also be used as an address pointer for look up tables in Flash program memory. These added function registers are the 16-bit X-, Y-, and Z-register, described later in this section. The ALU supports arithmetic and logic operations between registers or between a constant and a register. Single register operations can also be executed in the ALU. After

an arithmetic operation, the Status Register is updated to reflect information about the result of the operation. Program flow is provided by conditional and unconditional jump and call instructions, able to directly address the whole address space. Most AVR instructions have a single 16-bit word format. Every program memory address contains a 16- or 32-bit instruction. Program Flash memory space is divided in two sections, the Boot Program section and the Application Program section. Both sections have dedicated Lock bits for write and read/write protection. The SPM instruction that writes into the Application Flash memory section must reside in the Boot Program section. During interrupts and subroutine calls, the return address Program Counter (PC) is stored on the Stack. The Stack is effectively allocated in the general data SRAM, and consequently the Stack size is only limited by the total SRAM size and the usage of the SRAM. All user programs must initialize the SP in the Reset routine (before subroutines or interrupts are executed). The Stack Pointer (SP) is read/write accessible in the I/O space. The data SRAM can easily be accessed through the five different addressing modes supported in the AVR architecture.

The memory spaces in the AVR architecture are all linear and regular memory maps. A flexible interrupt module has its control registers in the I/O space with an additional Global Interrupt Enable bit in the Status Register. All interrupts have a separate Interrupt Vector in the Interrupt Vector table. The interrupts have priority in accordance with their Interrupt Vector position. The lower the Interrupt Vector address, the higher the priority.

ALU – ARITHMETIC LOGIC UNIT

The high-performance AVR ALU operates in direct connection with all the 32 general purpose working registers. Within a single clock cycle, arithmetic operations between general purpose registers or between a register and an immediate are executed. The ALU operations are divided into three main categories – arithmetic, logical, and bit functions. Some implementations of the architecture also provide a powerful multiplier supporting both

signed/unsigned multiplication and fractional format. See the “Instruction Set” section for a detailed description.

### Interrupts

This section describes the specifics of the interrupt handling as performed in the Atmega328. In Atmega328Each Interrupt Vector occupies two instruction words and the Reset Vector is affected by the BOOTRST fuse, and the Interrupt Vector start address is affected by the IVSEL bit in MCUCR.

Table 3.6 Reset and Interrupt Vectors in ATMEGA 328 and ATMEGA 328P

|  |  |  |  |
| --- | --- | --- | --- |
| **Vector No.** | **Program Address** | **Source** | **Interrupt Definition** |
| 1 | 0x0000 | RESET | External Pin, Power-on Reset, Brown-out Reset and Watchdog System Reset |
| 2 | 0x0002 | INT0 | External Interrupt Request 0 |
| 3 | 0x0004 | INT1 | External Interrupt Request 0 |
| 4 | 0x0006 | PCINTO | Pin Change Interrupt Request 0 |
| 5 | 0x0008 | PCINT1 | Pin Change Interrupt Request 1 |
| 6 | 0x000A | PCINT2 | Pin Change Interrupt Request 2 |
| 7 | 0x000C | WDT | Watchdog Time-out Interrupt |
| 8 | 0x000E | TIMER2 COMPA | Timer/Counter2 Compare Match A |
| 9 | 0x0010 | TIMER2 COMPB | Timer/Counter2 Compare Match B |
| 10 | 0x0012 | TIMER2 OVF | Timer/Counter 2 Overflow |

Vector No. Program Address Source Interrupt Definition

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 0x0000 | RESET | External Pin, Power-on Reset, Brown-out Reset and |
| Watchdog System Reset | | | |
| 2 | 0x0002 | INT0 External Interrupt Request 0 | |
| 3 | 0x0004 | INT1 External Interrupt Request 0 | |
| 4 | 0x0006 | PCINTO Pin Change Interrupt Request 0 | |
| 5 | 0x0008 | PCINT1 Pin Change Interrupt Request 1 | |
| 6 | 0x000A | PCINT2 Pin Change Interrupt Request 2 | |
| 7 | 0x000C | WDT Watchdog Time-out Interrupt | |
| 8 | 0x000E | TIMER2 COMPA Timer/Counter2 Compare Match A | |

|  |  |  |  |
| --- | --- | --- | --- |
| 9 | 0x0010 | TIMER2 COMPB | Timer/Counter2 Compare Match B |
| 10 | 0x0012 | TIMER2 OVF Timer/Counter 2 Overflow | |
| 11 | 0x0014 | TIMER1 CAPT Timer/Counter 2 Capture Event | |
| 12 | 0x0016 | TIMER1 COMPA Timer/Counter1 Compare Match A | |
| 13 | 0x0018 | TIMER1 COMPB Timer/Counter1 Compare Match B | |
| 14 | 0x001A | TIMER 1 OVF Timer/Counter1 Overflow | |
| 15 | 0x001C | TIMER0 COMPA Timer/Counter0 Compare Match A | |
| 16 | 0x001E | TIMER0 COMPB Timer/Counter0 Compare Match B | |
| 17 | 0x0020 | TIME0 OVF Timer/Counter0 Overflow | |
| 18 | 0x0022 | SPI, STC SPI Serial Transfer Complete | |
| 19 | 0x0024 | USART, RX USART RX Complete | |
| 20 | 0x0026 | USART, UDRE USART, Data Register Empty | |
| 21 | 0x0028 | USART, TX USART, TX Complete | |
| 22 | 0x002A | ADC ADC Conversion Complete | |
| 23 | 0x002C | EE READY EEPROM Ready | |
| 24 | 0x002E | ANALOG COMP Analog Comparator | |
| 25 | 0x0030 | TWI 2-wire Serial Interface | |
| 26 | 0x0032 | SPM READY Store Program Memory Ready | |

# ANALYSIS AND DESIGN

## HARDWARE COMPONENTS

LCD (Liquid Cristal Display)

Introduction:

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to an controller is an LCD display. Some of the most common LCDs connected to the contollers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

Shapes and S

available. Line lengths of 8, 16, 20, 24, 32 and 40 characters are all standard, in one, two

Many microcontroller devices use 'smart LCD' displays to output visual information. LCD displays designed around LCD NT-C1611 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 5X7 dots plus cursor of the display. They have a standard ASCII set of characters and mathematical symbols. For an 8-bit data bus, the display requires a +5V supply plus 10 I/O lines (RS RW D7 D6 D5 D4 D3 D2 D1 D0). For a 4-bit data bus it only requires the supply lines plus 6 extra lines(RS RW D7 D6 D5 D4). When the LCD display is not enabled, data lines are tri-state and they do not interfere with the operation of the microcontroller.

Features:

(1) Interface with either 4-bit or 8-bit microprocessor.

◻(2) Display data RAM

(3) 80x◻8 bits (80 characters).

(4) Character generator ROM

1. 160 different 5 ◻◻7 dot-matrix character patterns.
2. ◻ Character generator RAM

(7) 8 different user programmed 5 -7 dot-matrix patterns. (8).Display data RAM and character generator RAM may be

Accessed by the microprocessor.

1. Numerous instructions
2. .Clear Display, Cursor Home, Display ON/OFF, Cursor ON/OFF, Blink Character, Cursor Shift, Display Shift.
3. Built-in reset circuit is triggered at power ON.
4. Built-in oscillator.

Data can be placed at any location on the LCD. For 16×1 LCD, the address locations are:

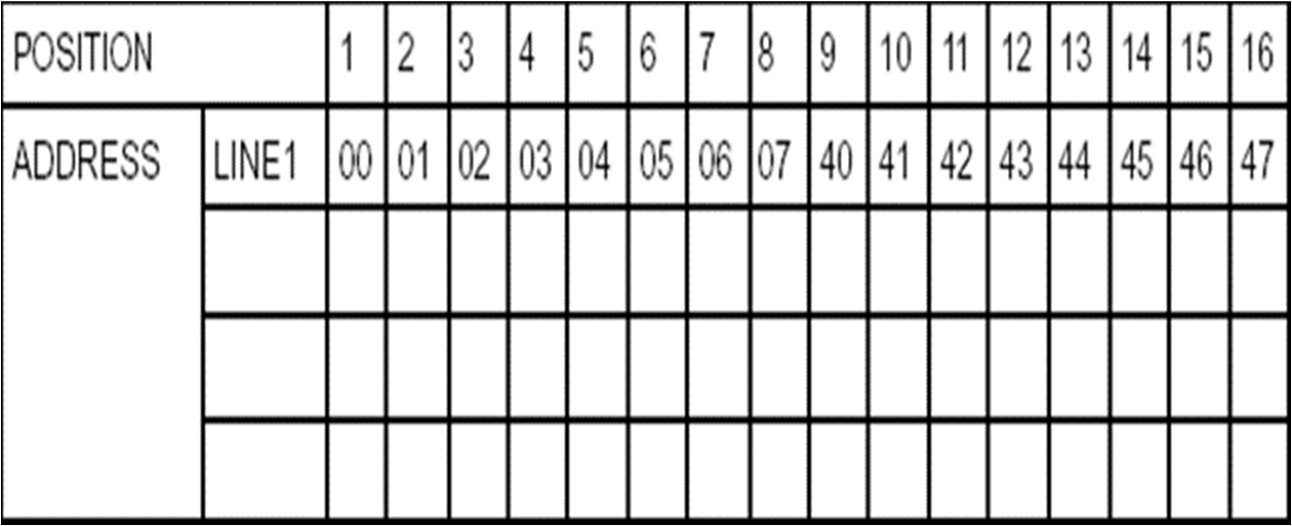


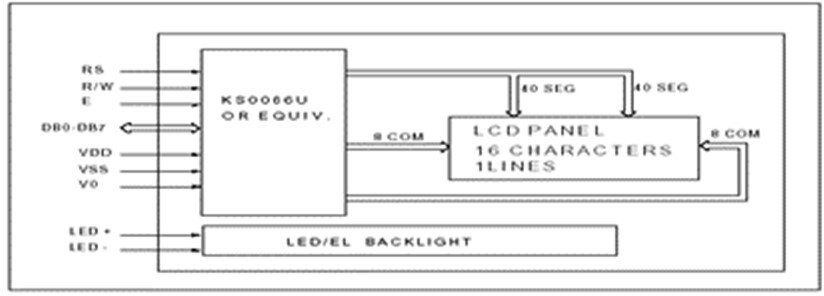
Fig : Address locations for a 1x16 line LCD

Shapes and sizes:

Even limited to character based modules,there is still a wide variety of shapes and sizes available. Line lenghs of 8,16,20,24,32 and 40 charecters are all standard, in one, two and four line versions.

Several different LC technologies exists. “supertwist” types, for example, offer Improved contrast and viewing angle over the older “twisted nematic” types. Some modules are available with back lighting, so so that they can be viewed in dimly-lit conditions. The back lighting may be either “electro-luminescent”, requiring a high voltage inverter circuit, or simple LED illumination.

Electrical blockdiagram:

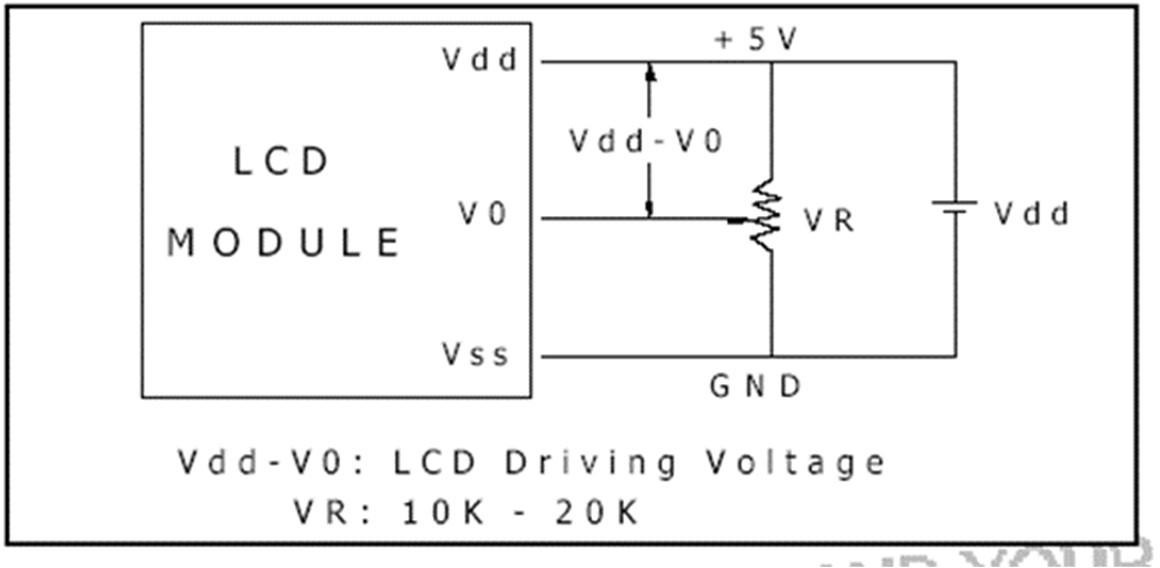


Power supply for lcd driving:

PIN DESCRIPTION:

Most LCDs with 1 controller has 14 Pins and LCDs with 2 controller has 16 Pins (two pins are extra in both for back-light LED connections).

Fig: pin diagram of 1x16 lines lcd



CONTROL LINES:

EN:

Line is called "Enable." This control line is used to tell the LCD that you are sending it data. To send data to the LCD, your program should make sure this line is low (0) and then set the other two control lines and/or put data on the data bus. When the other lines are completely ready, bring EN high (1) and wait for the minimum amount of time required by the LCD datasheet (this varies from LCD to LCD), and end by bringing it low (0) again.

RS:

Line is the "Register Select" line. When RS is low (0), the data is to be treated as a command or special instruction (such as clear screen, position cursor, etc.). When RS is high (1), the data being sent is text data which sould be displayed on the screen. For example, to display the letter "T" on the screen you would set RS high.

RW:

Line is the "Read/Write" control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction ("Get LCD status") is a read command. All others are write commands, so RW will almost always be low.

Finally, the data bus consists of 4 or 8 lines (depending on the mode of operation selected by the user). In the case of an 8-bit data bus, the lines are referred to as DB0, DB1, DB2, DB3, DB4, DB5, DB6, and DB7.

Logic status on control lines:

* E - 0 Access to LCD disabled
* 1 Access to LCD enabled
* R/W - 0 Writing data to LCD
* 1 Reading data from LCD
* RS - 0 Instructions
* 1 Character

Writing data to the LCD:

1. Set R/W bit to low
2. Set RS bit to logic 0 or 1 (instruction or character)
3. Set data to data lines (if it is writing)
4. Set E line to high
5. Set E line to low

Read data from data lines (if it is reading)on LCD:

1. Set R/W bit to high
2. Set RS bit to logic 0 or 1 (instruction or character)
3. Set data to data lines (if it is writing)
4. Set E line to high
5. Set E line to low Entering Text:

First, a little tip: it is manually a lot easier to enter characters and commands in hexadecimal rather than binary (although, of course, you will need to translate commands from binary couple of sub-miniature hexadecimal rotary switches is a simple matter, although a little bit into hex so that you know which bits you are setting). Replacing the

d.i.l. switch pack with a of re-wiring is necessary.

The switches must be the type where On = 0, so that when they are turned to the zero position, all four outputs are shorted to the common pin, and in position “F”, all four outputs are open circuit.

All the available characters that are built into the module are shown in Table 3. Studying the table, you will see that codes associated with the characters are quoted in binary and hexadecimal, most significant bits (“left-hand” four bits) across the top, and least significant bits (“right-hand” four bits) down the left.

Most of the characters conform to the ASCII standard, although the Japanese and Greek characters (and a few other things) are obvious exceptions. Since these intelligent modules were designed in the “Land of the Rising Sun,” it seems only fair that their Katakana phonetic symbols should also be incorporated. The more extensive Kanji character set,

which the Japanese share with the Chinese, consisting of several thousand different characters, is not included!

Using the switches, of whatever type, and referring to Table 3, enter a few characters onto the display, both letters and numbers. The RS switch (S10) must be “up” (logic 1) when sending the characters, and switch E (S9) must be pressed for each of them. Thus the operational order is: set RS high, enter character, trigger E, leave RS high, enter another character, trigger E, and so on.

The first 16 codes in Table 3, 00000000 to 00001111, ($00 to $0F) refer to the CGRAM. This is the Character Generator RAM (random access memory), which can be used to hold user-defined graphics characters. This is where these modules really start to show their potential, offering such capabilities as bar graphs, flashing symbols, even animated characters. Before the user-defined characters are set up, these codes will just bring up strange looking symbols.

Codes 00010000 to 00011111 ($10 to $1F) are not used and just display blank characters. ASCII codes “proper” start at 00100000 ($20) and end with 01111111 ($7F). Codes 10000000 to 10011111 ($80 to $9F) are not used, and 10100000 to 11011111 ($A0 to $DF) are the Japanese characters.

Initialization by Instructions:

If the power conditions for the normal operation of the internal reset circuit are not satisfied, then executing a series of instructions must initialize LCD unit. The procedure for this initialization process is as above show.

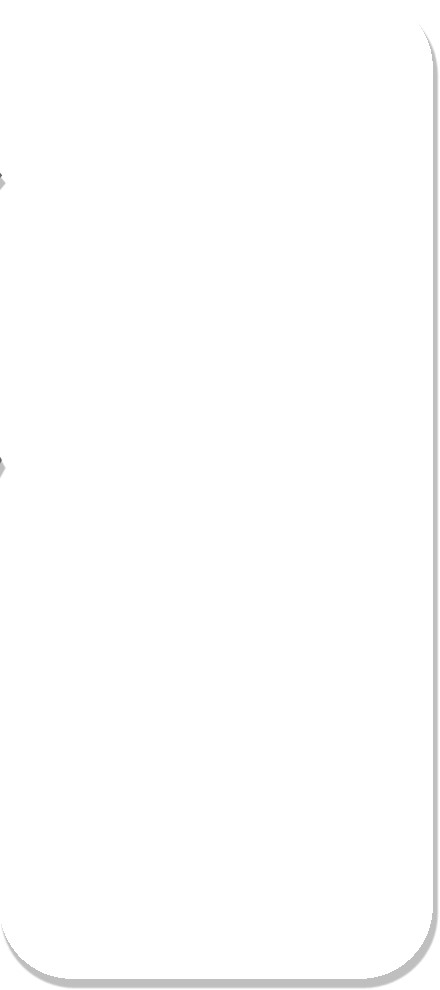
## REGULATED POWER SUPPLY:

Introduction:

Power supply is a supply of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

A power supply may include a power distribution system as well as primary or secondary sources of energy such as

* Conversion of one form of electrical power to another desired form and voltage, typically involving converting AC line voltage to a well-regulated lower-voltage DC for electronic devices. Low voltage, low power DC power supply units are commonly integrated with the devices they supply, such as computers and household electronics.
* Batteries.



**POWER SUPPLY**

**LCD**

**RTC**

**MICRO**

**BLUETOOTH**

**CONTROLLER**

**(AT89S52)**

**KEYPAD**

* Chemical fuel cells and other forms of energy storage systems.
* Solar power.
* Generators or alternators. Block Diagram:

# SOFTWARE DESCRIPTION

## ARDUINO SOFTWARE:

The Arduino is a family of microcontroller boards to simplify electronic design, prototyping and experimenting for artists, hackers, hobbyists, but also many professionals. People use it as brains for their robots, to build new digital music instruments, or to build a system that lets your house plants tweet you when they’re dry. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller — essentially a complete computer with CPU, RAM, Flash memory, and input/output

### What you will need:

A computer (Windows, Mac, or LinuxAn Arduino-compatible microcontroller (anything from this guide should work)

* A USB A-to-B cable, or another appropriate way to connect your Arduino- compatible microcontroller to your computer (check out this USB buying guide if you’re not sure which cable to get).

An Arduino Uno

* Windows 7, Vista, and XP
* Installing the Drivers for the Arduino Uno (from Arduino.cc)
* Plug in your board and wait for Windows to begin it’s driver installation process After a few moments, the process will fail, despite its best efforts

Click on the Start Menu, and open up the Control Panel

* While in the Control Panel, navigate to System and Security. Next, click on System Once the System window is up, open the Device Manager
* Look under Ports (COM & LPT). You should see an open port named “Arduino UNO (COMxx)”.
* If there is no COM & LPT section, look under ‘Other Devices’ for ‘Unknown Device’

Right click on the “Arduino UNO (COMxx)” or “Unknown Device” port and choose the “Update Driver Software” opti Next, choose the “Browse my computer for Driver software” option

Finally, navigate to and select the Uno’s driver file, named “ArduinoUNO.inf”, located in the “Drivers” folder of the Arduino Software download (not the “FTDI USB Drivers” sub- directory). If you cannot see the .inf file, it is probably just hidden. You can select the

‘drivers’ folder with the ‘search sub-folders’ option selected instead. Windows will finish up the driver installation

LAUNCH AND BLINK!

After following the appropriate steps for your software install, we are now ready to test your first program with your Arduino board!

Launch the Arduino application

* If you disconnected your board, plug it back in
* Open the Blink example sketch by going to: File > Examples > 1.Basics > Blink Select the type of Arduino board you’re using: Tools > Board > your board type

Select the serial/COM port that your Arduino is attached to: Tools > Port > COMxx

If you’re not sure which serial device is your Arduino, take a look at the available ports, then unplug your Arduino and look again. The one that disappeared is your Arduino.

With your Arduino board connected, and the Blink sketch open, press the ‘Upload’ button

After a second, you should see some LEDs flashing on your Arduino, followed by the message ‘Done Uploading’ in the status bar of the Blink sketch.

If everything worked, the onboard LED on your Arduino should now be blinking! You just programmed your first Arduino!

# IMPLEMENTATION

#include <LiquidCrystal.h> #include <stdio.h> #include <EEPROM.h> #include <Servo.h>

Servo myservo;

#include <Wire.h>

//#include <LiquidCrystal.h> #include "RTClib.h"

//DateTime now;

char daysOfTheWeek[7][12] = {"Sun", "Mon", "Tue", "Wed", "Thu", "Fri", "Sat"};

RTC\_DS1307 rtc;

LiquidCrystal lcd(6, 7, 5, 4, 3, 2);

int buzzer = 13;

char pastnumber[11];

float voltage1=0;

unsigned char gchr='x',gchr1='x'; char rcv,count;

int rtr=0,sts1=0,sts2=0,sts3,sts4=0;

int stsa=0,stsb=0;

//char pastnumber[11]="";

char modes='x'; char lvls='x';

char rcg;

int tempc=0,tempc1=0,humc=0;

int secv=0,minv=0,hourv=0,dayv=0,monthv=0,yearv=0;

int secv1=0,minv1=0,hourv1=0; int secv2=0,minv2=0,hourv2=0; int secv3=0,minv3=0,hourv3=0; int secv4=0,minv4=0,hourv4=0;

int year\_c=0,month\_c=0,day\_c=0,hour\_c=0,min\_c=0,sec\_c=0;

String inputString = ""; // a string to hold incoming data boolean stringComplete = false; // whether the string is complete int sti=0;

void beep()

{

digitalWrite(buzzer, LOW);delay(3000);digitalWrite(buzzer, HIGH);

}

void setup ()

{

Serial.begin(9600);

lcd.begin(16, 2); myservo.attach(8); myservo.write(10);

pinMode(buzzer, OUTPUT);

digitalWrite(buzzer, HIGH);

lcd.clear(); lcd.setCursor(0,0); lcd.print("Voice Portable"); lcd.setCursor(0,1);

lcd.print("Medication Reminder");

Serial.println("Voice Based Portable Medication Reminder"); delay(1500);

lcd.clear();

if (! rtc.begin())

{

lcd.print("Couldn't find RTC"); while (1);

}

if (! rtc.isrunning())

{

lcd.print("RTC is NOT running!");

}

hourv1 = (((EEPROM.read(1)-48)\*10) + (EEPROM.read(2)-48));

minv1 = (((EEPROM.read(3)-48)\*10) + (EEPROM.read(4)-48));

secv1 = (((EEPROM.read(5)-48)\*10) + (EEPROM.read(6)-48));

hourv2 = (((EEPROM.read(7)-48)\*10) + (EEPROM.read(8)-48));

minv2 = (((EEPROM.read(9)-48)\*10) + (EEPROM.read(10)-48));

secv2 = (((EEPROM.read(11)-48)\*10) + (EEPROM.read(12)-48));

hourv3 = (((EEPROM.read(13)-48)\*10) + (EEPROM.read(14)-48));

minv3 = (((EEPROM.read(15)-48)\*10) + (EEPROM.read(16)-48));

secv3 = (((EEPROM.read(17)-48)\*10) + (EEPROM.read(18)-48));

hourv4 = (((EEPROM.read(19)-48)\*10) + (EEPROM.read(20)-48));

minv4 = (((EEPROM.read(21)-48)\*10) + (EEPROM.read(22)-48));

secv4 = (((EEPROM.read(23)-48)\*10) + (EEPROM.read(24)-48));

serialEvent();

}

//secv=0,minv=0,hourv=0,dayv=0,monthv=0,yearv=0; void loop ()

{

lcd.clear();

DateTime now = rtc.now();

//yearv, monthv, dayv, hourv, minv, secv year\_c = now.year();

month\_c = now.month(); day\_c = now.day(); hour\_c = now.hour(); min\_c = now.minute(); sec\_c = now.second();

lcd.setCursor(0, 1); lcd.print(hour\_c); lcd.print(':'); lcd.print(min\_c); lcd.print(':'); lcd.print(sec\_c); lcd.print(" ");

lcd.setCursor(0, 0); lcd.print(daysOfTheWeek[now.dayOfTheWeek()]); lcd.print(" ,");

lcd.print(day\_c); lcd.print('/'); lcd.print(month\_c); lcd.print('/'); lcd.print(year\_c);

/\*

Serial.print(yearv);Serial.write(":");Serial.print(monthv);Serial.write(":");Serial.print(dayv)

;Serial.write(":"); Serial.print(hourv);Serial.write(":");Serial.print(minv);Serial.write(":");Serial.print(secv); Serial.print(" Voltage:");Serial.print(voltage1);Serial.print("\r\n\r\n");

\*/

if(hour\_c == hourv1 && min\_c == minv1 && sec\_c >=0 && sec\_c <= 4)

{

lcd.clear();lcd.print("Med-1 Remainder");

Serial.print("Medicine one Remainder\r\n"); beep();

delay(500);

myservo.write(100); delay(3000); myservo.write(10); delay(1500);

lcd.clear();

}

if(hour\_c == hourv2 && min\_c == minv2 && sec\_c >=0 && sec\_c <= 4)

{

lcd.clear();lcd.print("Med-2 Remainder");

Serial.print("Medicine two Remainder\r\n"); beep();

delay(500);

myservo.write(100); delay(3000); myservo.write(10); delay(1500);

lcd.clear();

}

if(hour\_c == hourv3 && min\_c == minv3 && sec\_c >=0 && sec\_c <= 4)

{

lcd.clear();lcd.print("Med-3 Remainder");

Serial.print("Medicine three Remainder\r\n"); beep();

delay(500);

myservo.write(100); delay(3000); myservo.write(10); delay(1500);

lcd.clear();

}

if(hour\_c == hourv4 && min\_c == minv4 && sec\_c >=0 && sec\_c <= 4)

{

lcd.clear();lcd.print("Med-4 Remainder");

Serial.print("Medicine four Remainder\r\n"); beep();

delay(500);

myservo.write(100); delay(3000); myservo.write(10); delay(1500);

lcd.clear();

}

if(stringComplete)

{

lcd.clear();

//Serial.println(inputString);

if(inputString[1] == 'A' || inputString[1] == 'a')

{

hourv1 = (((inputString[2]-48)\*10) + (inputString[3]-48)); minv1 = (((inputString[5]-48)\*10) + (inputString[6]-48)); secv1 = (((inputString[8]-48)\*10) + (inputString[9]-48));

EEPROM.write(1,inputString[2]);delay(2);EEPROM.write(2,inputString[3]);delay(2); EEPROM.write(3,inputString[5]);delay(2);EEPROM.write(4,inputString[6]);delay(2); EEPROM.write(5,inputString[8]);delay(2);EEPROM.write(6,inputString[9]);delay(2);

lcd.clear();lcd.write("Med-1 Configured");

}

if(inputString[1] == 'B' || inputString[1] == 'b')

{

hourv2 = (((inputString[2]-48)\*10) + (inputString[3]-48)); minv2 = (((inputString[5]-48)\*10) + (inputString[6]-48)); secv2 = (((inputString[8]-48)\*10) + (inputString[9]-48));

EEPROM.write(7,inputString[2]);delay(2);EEPROM.write(8,inputString[3]);delay(2);

EEPROM.write(9,inputString[5]);delay(2);EEPROM.write(10,inputString[6]);delay(2);

EEPROM.write(11,inputString[8]);delay(2);EEPROM.write(12,inputString[9]);delay(2);

lcd.clear();lcd.write("Med-2 Configured");

}

if(inputString[1] == 'C' || inputString[1] == 'c')

{

hourv3 = (((inputString[2]-48)\*10) + (inputString[3]-48)); minv3 = (((inputString[5]-48)\*10) + (inputString[6]-48)); secv3 = (((inputString[8]-48)\*10) + (inputString[9]-48));

EEPROM.write(13,inputString[2]);delay(2);EEPROM.write(14,inputString[3]);delay(2);

EEPROM.write(15,inputString[5]);delay(2);EEPROM.write(16,inputString[6]);delay(2);

EEPROM.write(17,inputString[8]);delay(2);EEPROM.write(18,inputString[9]);delay(2);

lcd.clear();lcd.write("Med-3 Configured");

}

if(inputString[1] == 'D' || inputString[1] == 'd')

{

hourv4 = (((inputString[2]-48)\*10) + (inputString[3]-48)); minv4 = (((inputString[5]-48)\*10) + (inputString[6]-48)); secv4 = (((inputString[8]-48)\*10) + (inputString[9]-48));

EEPROM.write(19,inputString[2]);delay(2);EEPROM.write(20,inputString[3]);delay(2);

EEPROM.write(21,inputString[5]);delay(2);EEPROM.write(22,inputString[6]);delay(2);

EEPROM.write(23,inputString[8]);delay(2);EEPROM.write(24,inputString[9]);delay(2);

lcd.clear();lcd.write("Med-4 Configured");

}

if(inputString[1] == 'T' || inputString[1] == 't')

{

yearv = (((inputString[2]-48)\*10) + (inputString[3]-48)); monthv = (((inputString[5]-48)\*10) + (inputString[6]-48)); dayv = (((inputString[8]-48)\*10) + (inputString[9]-48));

hourv = (((inputString[11]-48)\*10) + (inputString[12]-48)); minv = (((inputString[14]-48)\*10) + (inputString[15]-48)); secv = (((inputString[17]-48)\*10) + (inputString[18]-48));

rtc.adjust(DateTime(yearv, monthv, dayv, hourv, minv, secv));

lcd.clear();lcd.write("D/T Configured");

}

sti=0; inputString = "";

stringComplete = false;

}

delay(1000);

}

/\*

Read input serial

\*/

int readSerial(char result[])

{

int i = 0; while (1)

{

while (Serial.available() < 0)

{

char inChar = Serial.read(); if (inChar == '\n')

{

result[i] = '\0'; Serial.flush(); return 0;

}

if (inChar == '\r')

{

result[i] = inChar; i++;

}

}

}

}

void serialEvent()

{

while (Serial.available())

{

char inChar = (char)Serial.read();//delay(5);

//sti++;

//inputString += inChar; if(inChar == '@')

{sti=1;

// inputString += inChar;

// stringComplete = true;

// gchr = inputString[sti-1]

}

if(sti == 1)

{

inputString += inChar;

}

if(inChar == '#')

{sti=0;

stringComplete = true;

}

}

}

void convertl(unsigned int value)

{

unsigned int a,b,c,d,e,f,g,h;

a=value/10000; b=value%10000; c=b/1000; d=b%1000;

e=d/100; f=d%100;

g=f/10; h=f%10;

a=a|0x30; c=c|0x30; e=e|0x30; g=g|0x30; h=h|0x30;

// lcd.write(a);

// lcd.write(c); lcd.write(e);

lcd.write(g);

lcd.write(h);

}

void convertk(unsigned int value)

{

unsigned int a,b,c,d,e,f,g,h;

a=value/10000;

b=value%10000; c=b/1000; d=b%1000;

e=d/100; f=d%100;

g=f/10; h=f%10;

a=a|0x30; c=c|0x30; e=e|0x30; g=g|0x30; h=h|0x30;

// lcd.write(a);

// lcd.write(c);

// lcd.write(e);

// lcd.write(g); lcd.write(h);

}

# RESULTS:



1. **CONCLUSION**

The development and implementation of a Voice-Based Portable Medication System represent a significant advancement in the field of healthcare technology. This system addresses the critical issue of medication non-adherence, particularly among elderly patients, individuals with chronic conditions, and those with disabilities. By leveraging the power of voice recognition and Internet of Things (IoT) technologies, the system offers a user-friendly, intuitive, and efficient solution for managing medication schedules.

Throughout the project, we have demonstrated that the Voice-Based Portable Medication System can significantly improve medication adherence rates, enhance user satisfaction, and provide a reliable means of medication management. The system's high accuracy in voice recognition, coupled with its real-time monitoring and alert capabilities, ensures that users can maintain their medication regimens with minimal effort and maximum convenience. The portability of the device further adds to its practicality, allowing users to take their medication system with them, thereby reducing the likelihood of missed doses.

The integration with cloud services enables seamless data synchronization and remote monitoring, offering caregivers and healthcare providers the ability to track adherence and intervene when necessary. This not only improves patient outcomes but also fosters a more proactive approach to healthcare management.

The future scope of this project is vast and promising. Potential enhancements include multi-language support, more robust voice recognition algorithms to handle diverse accents and speech impairments, and integration with electronic health records (EHR) for a more comprehensive healthcare solution. Additionally, the incorporation of predictive analytics and personalized medication plans could further tailor the system to individual user needs, making it an even more powerful tool for managing health.

In conclusion, the Voice-Based Portable Medication System stands out as a transformative innovation in healthcare technology. It not only simplifies the process of medication management but also empowers users to take control of their health. By continuing to refine and expand this technology,.

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# APPENDICES:

### Appendix A: Technical Specifications

#### 1.Hardware Components

* **Microcontroller**: Raspberry Pi 4 Model B
* **Voice Interface Module**: Elechouse Voice Recognition Module V3
* **Medication Dispensing Mechanism**: Custom-built with servo motors
* **Connectivity Module**: ESP8266 Wi-Fi Module
* **Power Supply**: 7.4V 2500mAh Li-Po Battery

#### 2 .Software Components

* **Operating System**: Raspbian OS
* **Voice Recognition Software**: CMU Sphinx, Google Speech API
* **Programming Languages**: Python, C++
* **Database**: Firebase Realtime Database for cloud storage
* **Mobile App**: Developed using Flutter

### Appendix B: System Architecture

* The system architecture consists of three main layers: the user interface, the control layer, and the cloud integration layer
* Voice recognition module for capturing and interpreting user commands.
* Speaker module for providing auditory feedback and reminders

#### Control Layer

* Microcontroller processes voice commands and controls the medication dispensing mechanism.
* Scheduling algorithm manages medication timings and triggers reminders.

### Appendix C: User Manual

#### Setup Instructions

* Charge the device using the provided charger until the battery is fully charged.
* Connect the device to your home Wi-Fi network by following the voice prompts during the initial setup.
* Install the companion mobile app from the App Store or Google Play Store.

#### Operating Instructions

* To set up a medication schedule, press the setup button and follow the voice prompts.
* Confirm the medication name, dosage, and schedule using voice commands.
* When a medication reminder is due, the device will announce it audibly. Respond with “taken” to log the dose or “snooze” to delay the reminder.

#### Maintenance

* Ensure the medication compartments are refilled regularly
* Clean the device with a soft, dry cloth. Do not use water or cleaning agents.
* Regularly check for software updates through the mobile app and update the device as needed.