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Digital Pill

Sangeetha I[1], Sowmiyashree K[2], Swetha K[3], Maheshwari D[4]

Student, Electronics and Communication Engineering, Agni College of Technology, Chennai, India[1,2,3]

Assistant Professor, Electronics and Communication Engineering, Agni College of Technology, Chennai, India[4]

Abstract: Digital pill is basically a multichannel sensor used for remote biomedical measurements using micro technology. This is used for the real-time measurement parameters such as pH, conductivity and dissolved oxygen. The sensors are fabricated using electron beam and photolithographic pattern integration and were controlled by an application specific integrated circuit (ASIC). Digital pills are ingestible miniaturized electromechanical devices representing a point of convergence between biomedical technology, medicine and the pharma industry. Electronics, sensors and miniature robotic technology can give access, analyse and manipulate the body from the inside. In particular, smart pills for drug delivery are an emerging technology; many different approaches to local drug delivery have been proposed, including transcutaneous and implantable means. Anyhow, swallow able smart pills for drug delivery are receiving increasing attention as the oral one is still the preferred route for drug administration, due to its high patient acceptance and low cost. Smart pills for drug delivery offer a number of significant opportunities for pharmaceutical industries because they may be used in a wide range of applications and enable therapies not possible with conventional means. Its high patient acceptance and low cost. Smart pills for drug delivery offer a number of significant opportunities for pharmaceutical industries because they may be used in a wide range of applications and enable therapies not possible with conventional means. The changes occur in human bodies are monitored and sent it to nearby monitor for doctor monitoring through wireless.

Keywords: ASIC, Pill, Drug

I. INTRODUCTION

An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. Examples of properties typical of embedded computers when compared with general-purpose ones are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interface with. However, by building intelligence mechanisms on the top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functionalities, well beyond those available. For example, intelligent techniques can be designed to manage power consumption of embedded system. Modern embedded systems are often based on microcontrollers (i.e., CPUs with integrated memory or peripheral interfaces) but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also still common, especially in more complex systems. In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class of computations, or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP). Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale. Embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, and largely complex systems like hybrid vehicles, MRI, and avionics. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

II. OBJECTIVES OF THE PROJECT

- Digital pill is basically a multichannel sensor used for remote biomedical measurements using micro technology. This is used for the real-time measurement parameters such as temperature, pH, conductivity and dissolved oxygen.

- The sensors are fabricated using electron beam and photolithographic pattern integration and were controlled by an application specific integrated circuit (ASIC). This paper proposes a smart pill with remind and consumption function.

- Which is used to give alert the user to take pills at a particular time and the pills required to take at that time comes out to the user to avoid confusion among medicines.

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- Smart pill box can reduce elderly family member's responsibility towards giving the correct and timely consumption of medicines. This system Get the feedback about pills from the user and Send purchase order to medical shop.

III. LITERATURE REVIEW

1. Deepiga and Sivasankari have designed the water monitoring systems such as tank water level sensing monitoring, water pollution monitoring and water pipeline leakage sensing monitoring. The microcontroller-based water level monitoring is used to indicate the level of water in the tank to agent. Leak detection in water pipelines, the pressure is calculated using force sensitive resistors (FSR) generated from a leak.

2. Adsul and Kumar have proposed a wireless leakage detection system using various sensors and microcontroller which makes system portable and non-destructive techniques (NDT). In the system, the parameters like humidity, temperature, pressure, sound detection and gas detection around leakage areas are detected using sensors and Arduino microcontroller.

3. Jayalakshmi and Gomathy have proposed the design and implementation of a water leakage monitoring and detection system to monitor and detect leak with help of wireless sensor. The objective of an enhanced system is to detect possible underground water leakage for residential water pipes that are monitored from a personal computer.

4. Daadoo and Daraghmi have focused on an application of wireless sensor networks for leakage detection in underground water pipes to overcome the problem of water dispersion. To address the problem and simplify the leakage identification process, the authors have designed a wireless network system making use of mobile wireless sensors.

5. Myles has explained the background theory and practical application of a fibre optic-based technology that uses Brillouin acoustic scattering to detect subtle changes in temperature in the cable. The paper will outline the background physics of the method, and provide results from a case study for leak detection of a brine pipeline.

6. Sithole et al have presented a practical low-cost Smart Water Meter device (SWMD) which is capable of determining possible leakages. Flow Meter sensors have been deployed to measure the quantity of water consumed by a consumer.

7. Kei describes about the service that install sensors at arbitrary intervals on water pipes in order to capture vibration caused by water leak, sends the acquired data to the cloud computer via wireless network or public switched telephone networks and identifies the leak location with high precision based on the results of data analysis

8. Medina et al have introduced a technique based on signal analysis for leak detection in water supply systems. The paper presents the feature extraction from pressure signals and their application to the identification of changes related to the onset of a leak. Example, signals were acquired from an experimental laboratory circuit, and features were extracted from temporal domain and from transformed signals.

9. Martini et al have presented the control of water leaks in water distribution networks represents a critical issue for all utilities involved in drinking water supply. The work deals with the detection of water leaks by using vibration monitoring technique.

10. Choi et al have proposed new leak detection and location method based on vibration sensors and generalised cross correlation techniques. The paper explains the theoretical variance of the time difference estimation error through summation in the discrete frequency domain and find the optimal regularization factor that minimises the theoretical variance in practical water pipe channels.

IV. PROPOSED SYSTEM

With up to 50 percent of people not taking their drugs as prescribed, medication adherence has been a huge challenge for the U.S. healthcare system. A lot of effort has gone into innovating ways to improve our compliance, with several digital and low-tech solutions already on the market. Pill boxes, text messages, and bottles equipped with a chip are all being used as potential strategies to improve pharmaceutical adherence. However, these innovative approaches have yet to provide compelling, validated evidence that a person has indeed swallowed their Medici the arrival of a "smart pill" that

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is embedded with a sensor now offers a novel way of tracking drug compliance. This new health technology has received a lot of scientific and media attention, as well as reactions from the public.
In this proposed system, it aims to monitor the patient's intakes of drug according to the doctor prescription. The valproate sensor senses the chemical potion in each tablet to identified the tablet details. All the parameters are monitored using PC in graphical user interface via WSN protocol. The person intake of drug is uploaded in the web page using IoT technology. The WSN is used to transmit and receive the data from the body.

Block Diagram:

i.Transmitter Diagram:

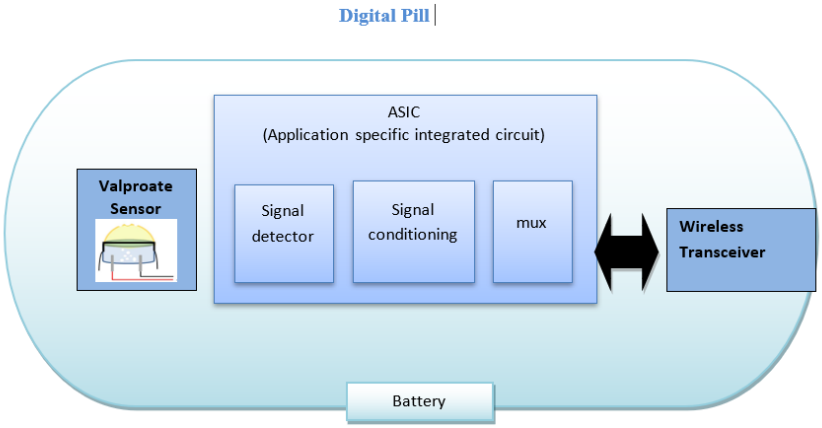

Fig.4.1 Transmitter diagram

ii.Receiver Diagram:

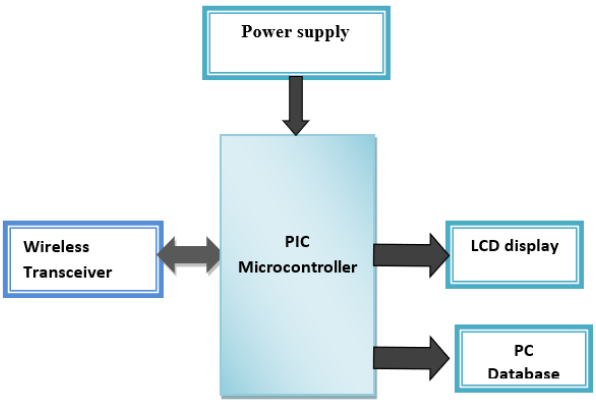

Fig.4.2 Receiver diagram

V. HARDWARE IMPLEMENTATION

1. PIC Microcontroller

Fig.5.1 PIC Microcontroller

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The PIC microcontroller PIC16F877A is one of the most renowned microcontrollers in the industry. This microcontroller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects. PIC16F877A also have much application in digital electronics circuits**.**

PIC16f877a finds its applications in a huge number of devices. It is used in remote sensors, security and safety devices, home automation and many industrial instruments. An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data. The cost of this controller is low and its handling is also easy. It is flexible and can be used in areas where microcontrollers have never been used before as in microprocessor applications and timer functions etc

- It has a smaller 35 instructions set.
- It can operate up to 20MHz frequency.
- The operating voltage is between 4.2 volts to 5.5 volts. If you provide it voltage more than 5.5 volts, it may get damaged permanently.
- It does not have an internal oscillator like other PIC18F46K22, PIC18F4550.
- The maximum current each PORT can sink or source is around 100mA. Therefore, the current limit for each GPIO pin of PIC16F877A is 10 milli ampere.
- It is available in four IC packaging such as 40-pin PDIP 44-pin PLCC, 44-pin TQFP, 44-pin QFN

PIN Configuration and Description of PIC16F877A Microcontroller

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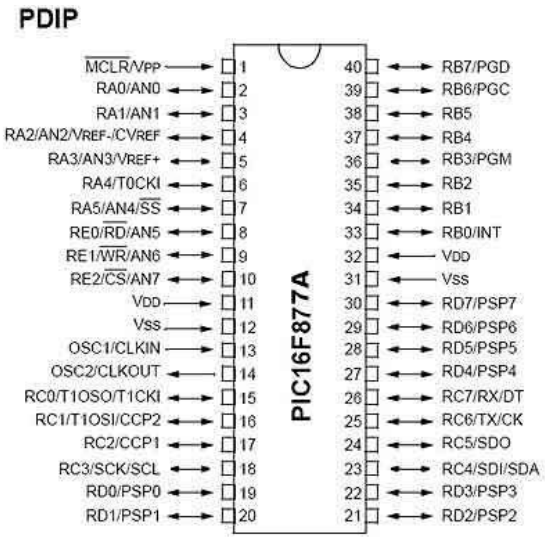

Fig.5.2 PIN Configuration

2. LCD Display

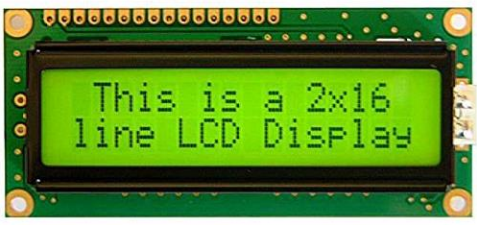

Fig.5.3 LCD Display

LCD is a flat –panel display or other electronically modulated optical device that uses the light –modulating properties of liquid crystals combined with polarizers. A 16x2 **LCD** means it can display **16** characters per line and there are **2** such lines. In this **LCD** each character is displayed in 5x7 pixel matrix. The **16** x **2** intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols.

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3. Step Down Transformer

i.Step down voltage level

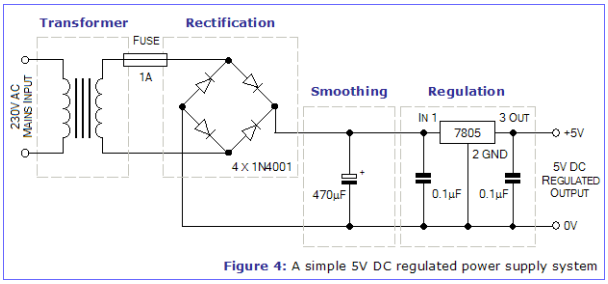

Fig.5.4 Step-down Transformer

The step-down converters are used for converting the high voltage into low voltage. The converter with output voltage less than the input voltage is called as a step-down converter, and the converter with output voltage greater than the input voltage is called as step-up converter. There are step-up and step-down transformers which are used to step up or step down the voltage levels. 230V AC is converted into 12V AC using a step-down transformer. 12V output of stepdown transformer is an RMS value and its peak value is given by the product of square root of two with RMS value, which is approximately 17V. Step-down transformer consists of two windings, namely primary and secondary windings where primary can be designed using a less-gauge wire with more number of turns as it is used for carrying low-current high-voltage power, and the secondary winding using a high-gauge wire with less number of turns as it is used for carrying high-current low-voltage power. Transformers works on the principle of Faraday's laws of electromagnetic induction. Step-down transformer consists of two windings, namely primary and secondary windings where primary can be designed using a less-gauge wire with a greater number of turns as it is used for carrying low-current high-voltage power, and the secondary winding using a high-gauge wire with a smaller number of turns as it is used for carrying high-current low-voltage power. Transformers works on the principle of Faraday's laws of electromagnetic induction.

ii.Convert AC to DC

230V AC power is converted into 12V AC (12V RMS value wherein the peak value is around 17V), but the required power is 5V DC; for this purpose, 17V AC power must be primarily converted into DC power then it can be stepped down to the 5V DC. But first and foremost, we must know how to convert AC to DC? AC power can be converted into DC using one of the power electronic converters called as Rectifier. There are different types of rectifiers, such as half-wave rectifier, full-wave rectifier and bridge rectifier. Due to the advantages of the bridge rectifier over the half and full wave rectifier, the bridge rectifier is frequently used for converting AC to DC. Bridge rectifier consists of four diodes which are connected in the form a bridge. We know that the diode is an uncontrolled rectifier which will conduct only forward bias and will not conduct during the reverse bias. If the diode anode voltage is greater than the cathode voltage then the diode is said to be in forward bias. During positive half cycle, diodes D2 and D4 will conduct and during negative half cycle diodes D1 and D3 will conduct. Thus, AC is converted into DC; here the obtained is not a pure DC as it consists of pulses. Hence, it is called as pulsating DC power.

Fig.5.5 Bridge Rectifier

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4. Valproate Sensor

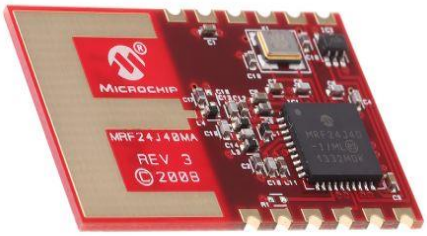

Fig.5.6 Valproate Sensor

Use the valproate Sensor just as you would a traditional valproate meter with the additional advantages of automated data collection, graphing, and data analysis. Typical activities using our valproate sensor include; Acid-base titrations, Studies of acids and bases. A valproate sensor is a device that measures the hydrogen-ion concentration in a solution, indicating its acidity or alkalinity. In addition to measuring the ph of liquids dissolved. The valproate of a solution indicates how acidic or basic (alkaline) it is. The valproate term translates the values of the hydrogen ion concentration- which ordinarily ranges between about 1 and 10 x -14-gram equivalents per litre - into numbers between 0 and 14

5. Zigbee – Wireless transceiver

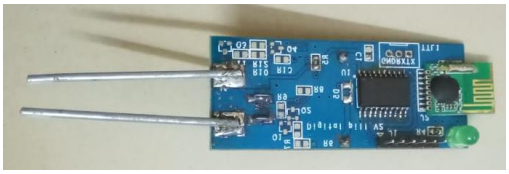

Fig.5.7 Zigbee

ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for Low-Rate Wireless Personal Area Networks (LR-WPANs), such as wireless light switches with lamps, electrical meters with in-home-displays, consumer electronics equipment via short-range radio needing low rates of data transfer. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. ZigBee is a low-cost, low-power, wireless mesh networking standard. First, the low cost allows the technology to be widely deployed in wireless control and monitoring applications. Second, the low power-usage allows longer life with smaller batteries. Third, the mesh networking provides high reliability and more extensive rang It is not capable of powerline networking though other elements of the Open HAN standards suite promoted by open AMI and Utility AMI deal with communications co-extant with AC power outlets

6. MRF24J40MA Module

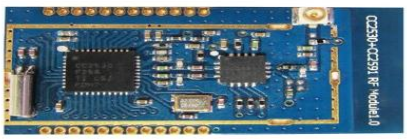

Fig.5.8 MRF24J40MA Module

The MRF24J40MA is a 2.4 GHz IEEE Std. 802.15.4™ compliant, surface mount module with integrated crystal, internal voltage regulator, matching circuitry and PCB antenna. The MRF24J40MA module operates in the non-licensed 2.4 GHz frequency band and is FCC, IC and ETSI compliant. The integrated module design frees the integrator from extensive RF and antenna design, and regulatory compliance testing, allowing quicker time to market.

7. UART RS232

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Fig.5.9 UART module

A universal asynchronous receiver/transmitter is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with other communication standards such as EIA RS-232. A UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device serial port. UARTs are now commonly included in microcontrollers. A dual UART or DUART combines two UARTs into a single chip. Many modern ICs now come with a UART that can also communicate synchronously; these devices are called USARTs.

8. MAX232

Fig.5.10 MAX232

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signa The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V. The later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors – 0.1 μF in place of the 1.0 μF capacitors used with the original device.

VI. SOFTWARE IMPLEMENATION

KEIL'S SOFTWARE

The Keil C51 C Compiler for the 8051 microcontroller is the most popular 8051 C compiler in the world. It provides more features than any other 8051 C compiler available today. The C51 Compiler allows you to write 8051 microcontroller applications in C that, once compiled, have the efficiency and speed of assembly language. Language extensions in the C51 Compiler give you full access to all resources of the 8051.The C51 Compiler translates C source files into relocatable object modules which contain full symbolic information for debugging with the µVision Debugger or an in-circuit emulator. In addition to the object file, the compiler generates a listing file which may optionally include symbol table and cross reference information.

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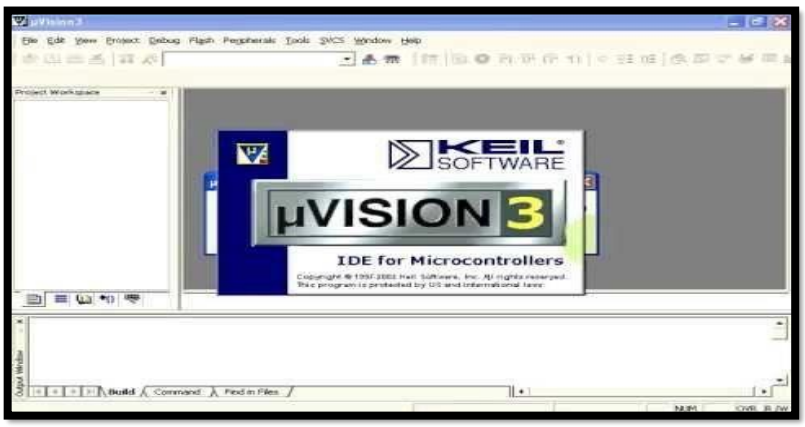

Fig 6.1 Keil's Micro vision 3 software

The Keil development tools for ARM offer numerous features and advantages that help you quickly and successfully develop embedded applications. They are easy to use and are guaranteed to help you achieve your design goals. The µVision IDE and Debugger is the central part of the Keil ARM development tools. µVision offers a Build Mode and a Debug Mode. In the µVision Build Mode you maintain the project files and generate the application. µVision uses either the GNU or ARM ADS/Real View™ development tools. In the µVision Debug Mode you verify your program either with a powerful CPU and peripheral simulator that connects the debugger to the target system. The ULINK allows you also to download your application into Flash ROM of your target system.

FEATURES

Nine basic data types, including 32-bit IEEE floating-point,

- Flexible variable allocation with bit, data, bdata, idata, xdata, and pdatamemory types,
- Interrupt functions may be written in C,
- Full use of the 8051 register banks,
- Complete symbol and type information for source-level debugging,
- Use of AJMP and ACALL instructions,
- Bit-addressable data objects,
- Built-in interface for the RTX51 Real-Time Kernel
- Support for dual data pointers on Atmel, AMD, Cypress, Dallas Semiconductor, Infineon, Philips, and Triscend microcontrollers,
- Support for the Philips 8*x*C750, 8*x*C751, and 8*x*C752 limited instruction sets,
- Support for the Infineon 80C517 arithmetic unit.

VII. CONCLUSION

Digital medicine technology is a promising field, particularly for certain patient populations. Increasing adherence and monitoring to improve patient outcomes is a goal for patients, clinicians, and insurance carriers. However, ethical challenges exist and must be considered as use of digital medicine-device products become available.

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