DESIGN AND CONSTRUCTION OF A MICROCONTROLLER BASED DIGITAL CALENDAR

BY

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MATRICULATION NUMBER:

2005/ 22056EE

ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

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A FINAL YEAR PROJECT SUBMITTED TO THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY,

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NOVEMBER, 2010

DEDICATION

This project is dedicated to almighty God and to my lovely and caring parent Mr. and Mrs. Mustapha.

DECLARATION

I Mustapha Hafiz Bola, declare that this work was done by me and has never been presented elsewhere for the award of a degree. I also hereby relinquish the copyright to the Federal University of Technology, Minna.

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ACKNOWLEDGEMENT

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My appreciation also extends to all staff of Electrical and Computer Engineering, for the knowledge impacted on me.

To my patient and all supportive project supervisor, Mr. Paul Abraham Attah I pray that the Almighty God will bless you abundantly.

ABSTRACT

The project is set out to design user friendly, low-cost digital calendar the device was designed to display the date, day and month also the project was sub divided into four units namely; Power supply unit, Real Time Clock unit, The central processing unit (microcontroller) and the Display unit. The programming aspect is essential because it is the factor that analyses and organizes the input and output signals as well as the display. The microcontroller unit was the into which the program is written, serves as the unifying component that brings the RTC and the LED display together to form a single device, as well as the power supply unit feeding all the sub unit.

TABLE OF CONTENT

CHAPTER ONE

1.1 INTRODUCTION

A calendar is a system of organizing units of time for the purpose of reckoning time over extended periods. By convention, the day is the smallest calendrical unit of time; the measurement of fractions of a day is classified as timekeeping. The generality of this definition is due to the diversity of methods that have been used in creating calendars. Although some calendars replicate astronomical cycles according to fixed rules, others are based on abstract, perpetually repeating cycles of no astronomical significance. Some calendars are regulated by astronomical observations, some carefully and redundantly enumerate every unit, and some contain ambiguities and discontinuities. Some calendars are codified in written laws; others are transmitted by oral tradition.

The increase in the complexity of human activities has prompted measurement, counting and accuracy hence time and date is very important. Calendar has become an integral part of human daily activity. The purpose of the calendar is to reckon past or future time, to show how many days until a certain event takes place or harvest, religious festival, how long since something important happened. The earliest calendars must have been strongly influenced by the geographical location of the people who made them. In colder countries, the concept of the year was determined by the seasons, specifically by the end of winter. But in warmer countries, where the seasons are less pronounced, the Moon became the basic unit for time reckoning; an old Jewish book says that "the Moon was created for the counting of the days."

Most of the oldest calendars were lunar calendars, based on the time interval from one new moon to the next. But even in a warm climate there are annual events that pay no attention to the phases of the Moon. In some areas it was a rainy season; in Egypt it was the annual flooding of the Nile River. The calendar had to account for these yearly events as well.

The increase in human population and advance in technology has prompt the existence of a digital calendar. This project is base on a Real Time Clock (RTC) which is programmed for a complete century i.e. one hundred years and a microcontroller chip, which is used to fetch data from the RTC and display it over LED display.

1.2 AIMS AND OBJECTIVES

The aim of this project is to construct and design microcontroller base digital calendar using a real time clock to implement it, which can be compared with the paper print calendar.

The objectives of this project are as follows:

- To make checking of date very easy.
- To improve technology in the society.
- To produce a cheaper and more affordable digital calendar.
- To achieve a real time system without control buttons

1.3 METHODOLOGY

In carrying out this project, an assembly language program was written to perform the reading of data from the real time clock and processed by the microcontroller to display on the LEDs. The HEX file for the source code was also generated using simulation software KEIL and programmed onto a blank AT89C52 IC. The operation and all other processes involved are entirely controlled by the microprocessor unit. In writing the program, care was taken to ensure that it was error free. Although this was a very difficult task which must be achieved before the HEX file was finally burned onto the AT89S52 IC chip.

LEDs are used to display the output in a way to resemble the paper calendar in which different types are used to indicate date, days and months i.e. 31 LEDs for date, 7 LEDs for days and 12 LEDs for months.

1.4 SCOPE AND LIMITATION

This project has been designed mainly to function as a digital calendar. It has the ability to display date, days and months with accuracy from now till the next 10 years, the AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM).

1.5 SOURCES OF MATERIAL

The materials used for this project work was sort for from within and outside Minna. Most of which was gotten from Lagos. Some resources were also gotten from the school and departmental library. Also the internet serves as a major resource bank for this project work.

1.6 PROJECT LAYOUT

CHAPTER ONE: This is the expository introduction to the project work. It contains the projects objectives, methodology, sources of material and the project layout.

CHAPTER TWO: Literature review and theoretical background forms the chapter two of this project work. It contains the necessary theoretical background, brief historical background, and the previous works in this area of study.

CHAPTER THREE: This is the design and implementation stage. Thus forming the major part of this project work. It contains the circuit diagram and explanation of each module, and all the components used.

CHAPTER FOUR: Testing, result and discussion forms the chapter four of this work. It also contains steps taken to test the work. The result is plotted or presented in tabular form as may be required.

CHAPTER FIVE: This is the summary of the whole work. The result obtained and problem encountered are summarized. Recommendations on how to improve the work are also stated.

REFERENCES: This contains all the list of books, magazines, journals, and websites that were read and cited inside then text of this report.

CHAPTER TWO

LITERATURE REVIEW /HISTORICAL BACKGROUND

2.0 HISTORICAL BACKGROUND

The common theme of calendar making is the desire to organize units of time to satisfy the needs and preoccupations of society Thus calendars serve as a link between mankind and the cosmos. It is little wonder that calendars have held a sacred status and have served as a source of social order and cultural identity. Calendars have provided the basis for planning agricultural, hunting, and migration cycles, for divination and prognostication, and for maintaining cycles of religious and civil events. Whatever their scientific sophistication, calendars must ultimately be judged as social contracts, not as scientific treatises.

According to a recent estimate (Fraser, 1987), there are about forty calendars used in the world today. The fundamental bases of the calendars are given, along with brief historical summaries.

- Egyptian calendar
- Lunar calendar
- Roman calendar
- Gregorian calendar
- Hebrew calendar
- Islamic calendar
- Indian calendar
- Chinese calendar
- Julian calendar

2.0.0. Egyptian Calendar: The ancient Egyptians used a calendar with 12 months of 30 days each, for a total of 360 days per year. About 4000 B.C. they added five extra days at the end of every year to bring it more into line with the solar year. These five days became a festival because it was thought to be unlucky to work during that time. The Egyptians had calculated that the solar year was actually closer to $365^1/4$ days, but instead of having a single leap day every four years to account for the fractional day they let the one-quarter day accumulate. After 1,460 solar years, or four periods of 365 years, 1,461 Egyptian years had passed. This means that as the years passed, the Egyptian months fell out of sync with the seasons, so that the summer months eventually fell during winter. Only once every 1,460 years did their calendar year coincide precisely with the solar year? In addition to the civic calendar, the Egyptians also had a religious calendar that was based on the $29^1/2$-day lunar cycle and was more closely linked with agricultural cycles and the movements of the stars.

2.0.1. Lunar Calendar: During antiquity the lunar calendar that best approximated a solar-year calendar was based on a 19-year period, with 7 of these 19 years having 13 months. In all, the period contained 235 months. Still using the lunation value of 291/2 days, this made a total of 6,9321/2 days, while 19 solar years added up to 6,939.7 days, a difference of just one week per period and about five weeks per century. Even the 19-year period required adjustment, but it became the basis of the calendars of the ancient Chinese, Babylonians, Greeks, and Jews. This same calendar was also used by the Arabs, but Muhammad later forbade shifting from 12 months to 13 months, so that the Islamic calendar now has a lunar year of about 354 days. As a result, the months of the Islamic calendar, as well as the Islamic religious festivals, migrate through all the seasons of the year.

2.0.2. Roman Calendar: When Rome emerged as a world power, the difficulties of making a calendar were well known, but the Romans complicated their lives because of their superstition that even numbers were unlucky. Hence their months were 29 or 31 days long, with the exception of February, which had 28 days. However, four months of 31 days, seven months of 29 days, and one month of 28 days added up to only 355 days. Therefore the Romans invented an extra month called Mercedonius of 22 or 23 days. It was added every second year.Even with Mercedonius, the Roman calendar eventually became so far off that Julius Caesar, advised by the astronomer Sosigenes, ordered a sweeping reform. 46 B.C. was made 445 days long by imperial decree, bringing the calendar back in step with the seasons. Then the solar year (with the value of 365 days and 6 hours) was made the basis of the calendar. The months were 30 or 31 days in length, and to take care of the 6 hours, every fourth year was made a 366-day year. Moreover, Caesar decreed the year began with the first of January, not with the vernal equinox in late March. This calendar was named the Julian calendar, after Julius Caesar, and it continues to be used by Eastern Orthodox churches for holiday calculations to this day. However, despite the correction, the Julian calendar is still 111/2 minutes longer than the actual solar year, and after a number of centuries, even 111/2 minutes adds up.

2.0.3Gregorian Calendar: By the 15th century the Julian calendar had drifted behind the solar calendar by about a week, so that the vernal equinox was falling around March 12 instead of around March 20. Pope Sixtus IV (who reigned from 1471 to 1484) decided that another reform was needed and called the German astronomer Regiomontanus to Rome to advise him. Regiomontanus arrived in 1475, but unfortunately he died shortly afterward, and the pope's plans for reform died with him.Then in 1545, the Council of Trent authorized Pope

Paul III to reform the calendar once more. Most of the mathematical and astronomical work was done by Father Christopher Clavius, S.J. The immediate correction, advised by Father Clavius and ordered by Pope Gregory XIII, was that Thursday, Oct. 4, 1582, was to be the last day of the Julian calendar. The next day would be Friday, Oct. 15. For long-range accuracy, a formula suggested by the Vatican librarian Aloysius Giglio was adopted: every fourth year is a leap year unless it is a century year like 1700 or 1800. Century years can be leap years only when they are divisible by 400 (e.g., 1600 and 2000). This rule eliminates three leap years in four centuries, making the calendar sufficiently accurate.In spite of the revised leap year rule, an average calendar year is still about 26 seconds longer than the Earth's orbital period. But this discrepancy will need 3,323 years to build up to a single day.

2.0.4. Hebrew Calendar: The codified Hebrew calendar as we know it today is generally considered to date from A.M. 4119 (+359), though the exact date is uncertain. At that time the patriarch Hillel II, breaking with tradition, disseminated rules for calculating the calendar. Prior to that time the calendar was regarded as a secret science of the religious authorities. The exact details of Hillel's calendar have not come down to us, but it is generally considered to include rules for intercalation over nineteen-year cycles. Up to the tenth century A.D., however, there was disagreement about the proper years for intercalation and the initial epoch for reckoning years. Information on calendrical practices prior to Hillel is fragmentary and often contradictory. The earliest evidence indicates a calendar based on observations of Moon phases. Since the Bible mentions seasonal festivals, there must have been intercalation. There was likely an evolution of conflicting calendrical practices. The Babylonian exile, in the first half of the sixth century B.C., greatly influenced the Hebrew calendar. This is visible today in the names of the months. The Babylonian influence may also have led to the practice of intercalating leap months. During the period of the Sanhedrin, a commitee of the Sanhedrin met to evaluate reports of sightings of the lunar crescent. If sightings were not possible, the new month was begun 30 days after the beginning of the previous month. Decisions on intercalation were influenced, if not determined entirely, by the state of vegetation and animal life. Although eight-year, nineteen-year, and longer- period intercalation cycles may have been instituted at various times prior to Hillel II, there is little evidence that they were employed consistently over long time spans.

2.0.5. Islamic Calendar: The form of the Islamic calendar, as a lunar calendar without intercalation, was laid down by the Prophet in the Qur'an (Sura IX, verse 36-37) and in his sermon at the Farewell Pilgrimage. This was a departure from the lunisolar calendar commonly used in the Arab world, in which months were based on first sightings of the lunar crescent, but an intercalary month was added as deemed necessary. Caliph 'Umar I is credited with establishing the Hijra Era in A.H. 17. It is not known how the initial date was determined. However, calculations show that the astronomical New Moon (i.e., conjunction) occurred on +622 July 14 at 0444 UT (assuming delta-T = 1.0 hour), so that sighting of the crescent most likely occurred on the evening of July 16.

2.0.6. Indian Calendar: The history of calendars in India is a remarkably complex subject owing to the continuity of Indian civilization and to the diversity of cultural influences. In the mid-1950s, when the Calendar Reform Committee made its survey, there were about 30 calendars in use for setting religious festivals for Hindus, Buddhists, and Jainists. Some of these were also used for civil dating. These calendars were based on common principles, though they had local characteristics determined by long-established customs and the astronomical practices of local calendar makers. In addition, Muslims in India used the

Islamic calendar, and the Indian government used the Gregorian calendar for administrative purposes. Early allusions to a lunisolar calendar with intercalated months are found in the hymns from the Rig Veda, dating from the second millennium B.C. Literature from 1300 B.C. to A.D. 300, provides information of a more specific nature. A five-year lunisolar calendar coordinated solar years with synodic and sidereal lunar months. Indian astronomy underwent a general reform in the first few centuries A.D., as advances in Babylonian and Greek astronomy became known. New astronomical constants and models for the motion of the Moon and Sun were adapted to traditional calendric practices. This was conveyed in astronomical treatises of this period known as *Siddhantas*, many of which have not survived. The *Surya Siddhanta*, which originated in the fourth century but was updated over the following centuries, influenced Indian calendrics up to development of mathematical astronomy in India. Although he does not deal explicitly with calendrics, this material is necessary for a full understanding of the history of India's calendars.

2.0.7. Chinese Calendar: In China the calendar was a sacred document, sponsored and promulgated by the reigning monarch. For more than two millennia, a Bureau of Astronomy made astronomical observations, calculated astronomical events such as eclipses, prepared astrological predictions, and maintained the calendar (Needham, 1959). After all, a successful calendar not only served practical needs, but also confirmed the consonance between Heaven and the imperial court. Analysis of surviving astronomical records inscribed on oracle bones reveals a Chinese lunisolar calendar, with intercalation of lunar months, dating back to the Shang dynasty of the fourteenth century B.C. Various intercalation schemes were developed for the early calendars, including the nineteen-year and 76-year lunar phase cycles that came to be known in the West as the Metonic cycle and Callipic cycle. From the earliest records, the beginning of the year occurred at a New Moon near the winter solstice. The choice of month for beginning the civil year varied with time and place, however. In the late second century B.C., a calendar reform established the practice, which continues today, of requiring the winter solstice to occur in month 11. This reform also introduced the intercalation system in which dates of New Moons are compared with the 24 solar terms. However, calculations were based on the mean motions resulting from the cyclic relationships. Inequalities in the Moon's motions were incorporated as early as the seventh century A.D. (Sivin, 1969), but the Sun's mean longitude was used for calculating the solar terms until 1644 (Liu and Stephenson, in press). Years were counted from a succession of eras established by reigning emperors. Although the accession of an emperor would mark a new era, an emperor might also declare a new era at various times within his reign. The introduction of a new era was an attempt to reestablish a broken connection between Heaven and Earth, as personified by the emperor. The break might be revealed by the death of an emperor, the occurrence of a natural disaster, or the failure of astronomers to predict a celestial event such as an eclipse. In the latter case, a new era might mark the introduction of new astronomical or calendrical models. Sexagenary cycles were used to count years, months, days, and fractions of a day using the set of Celestial Stems and Terrestrial Branches described in Section 6.1. Use of the sixty-day cycle is seen in the earliest astronomical records. By contrast the sixty-year cycle was introduced in the first century A.D. or possibly a century earlier (Tung, 1960; Needham, 1959). Although the day count has fallen into disuse in everyday life, it is still tabulated in calendars. The initial year (jia-zi) of the current year cycle began on 1984 February 2, which is the third day (bing-yin) of the day cycle. Western (pre-Copernican) astronomical theories were introduced to China by Jesuit missionaries in the seventeenth century. Gradually, more modern Western concepts became known. Following the revolution of 1911, the traditional practice of counting years from the accession of an emperor was abolished.

2.0.8 Julian calendar: The year -45 has been called the "year of confusion," because in that year Julius Caesar inserted 90 days to bring the months of the Roman calendar back to their traditional place with respect to the seasons. This was Caesar's first step in replacing a calendar that had gone badly awry. Although the pre-Julian calendar was lunisolar in inspiration, its months no longer followed the lunar phases and its year had lost step with the cycle of seasons (see Michels, 1967; Bickerman, 1974). Following the advice of Sosigenes, an Alexandrine astronomer, Caesar created a solar calendar with twelve months of fixed lengths and a provision for an intercalary day to be added every fourth year. As a result, the average length of the Julian calendar year was 365.25 days. This is consistent with the length of the tropical year as it was known at the time. Following Caesar's death, the Roman calendrical authorities misapplied the leap-year rule, with the result that every third, rather than every fourth, year was intercalary. Although detailed evidence is lacking, it is generally believed that Emperor Augustus corrected the situation by omitting intercalation from the Julian years -8 through +4. After this the Julian calendar finally began to function as planned. Through the Middle Ages the use of the Julian calendar evolved and acquired local peculiarities that continue to snare the unwary historian. There were variations in the initial epoch for counting years, the date for beginning the year, and the method of specifying the day of the month. Not only did these vary with time and place, but also with purpose. Different conventions were sometimes used for dating ecclesiastical records, fiscal transactions, and personal correspondence. Caesar designated January 1 as the beginning of the year. However, other conventions flourished at different times and places. The most popular alternatives were March 1, March 25, and December 25. This continues to cause problems for historians, since, for example, +998 February 28 as recorded in a city that began its year on March 1, would be the same day as +999 February 28 of a city that began the year on January 1. Days within the month were originally counted from designated division points within the month: Kalends, Nones, and Ides. The Kalends is the first day of the month. The Ides is the thirteenth of the month, except in March, May, July, and October, when it is the fifteenth day. The Nones is always eight days before the Ides (see Table 8.2.1). Dates falling between these division points are designated by counting inclusively backward from the upcoming division point. Intercalation was performed by repeating the day VI Kalends March, i.e., inserting a day between VI Kalends March (February 24) and VII Kalends March (February 23).

2.1 **Digital calendar:** It the means of achieving a calendar electronically which may be display in many ways such as LCD display, LED display and other means of electronic display but for this project LED is been used as the display medium i.e. using 7 LED to represent the 7 days in the week and 12 LED to represent the 12 month of the year while 31 LED is been used to represent the 31 days in a month. This was achieve with the use of three ICs and 50 LEDs cased with straw board of dimension

CHAPTER THREE

DESIGN AND IMPLEMENTATION

This design can be divided into four (4) major unit or parts. These subdivisions are as follows:

a. Power supply unit
b. Real time clock unit
c. Microcontroller unit
d. Display unit

3.0 BLOCK DIAGRAM

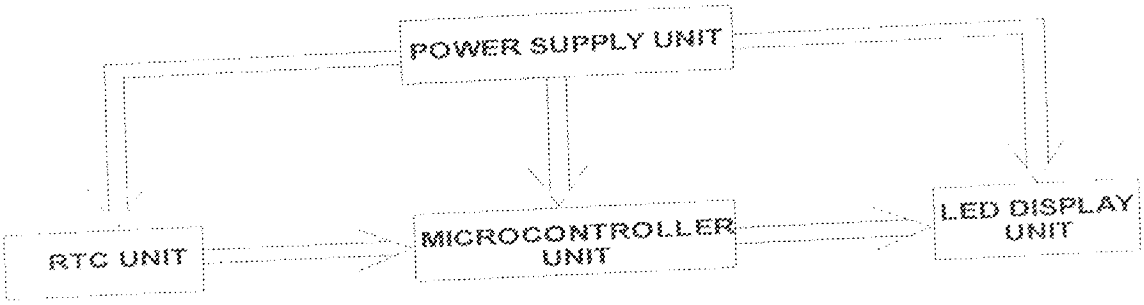


Fig. 3.1 project`s block diagram

3.1 POWER SUPPLY UNIT

The power supply from the220V AC mains is being stepped down to 15V AC by a step down transformer. The 15V AC is rectified into DC using a full bridge rectifier and then regulated using a voltage regulator 7812 and 7805.

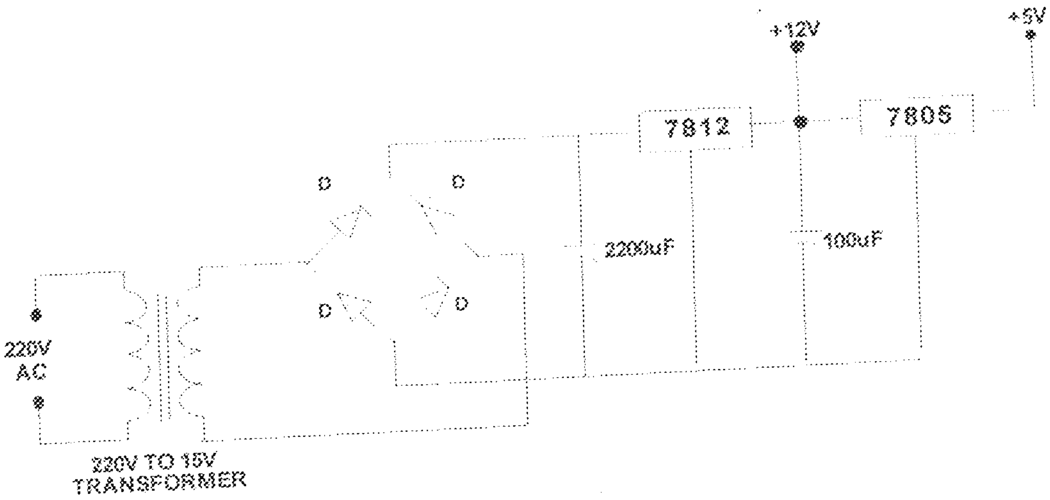


Fig. 3.1 power supply unit

3.1.1 TRANSFORMER

A transformer is an electrical AC component or equipment which consists of two or more coils that are linked together by mutual inductance. It is used to transfer electrical power from one coil to another through induction. It can be used to change voltage, current, or impedance from one value to another.

Power is applied to the transformer through one of the coil which is known as the PRIMARY winding. Power is taken from another coil known as the SECONDARY winding. The primary winding converts the electrical energy into magnetic energy while the secondary winding converts the magnetic energy back to electrical energy. The two winding are, therefore, magnetically coupled but electrically isolated from each other.

Two types of transformer construction are available. These are:

- Core-type
- Shell-type

in the core-type transformer, a single magnetic circuit is used. In the shell-type, a double magnetic circuit is used.

3.1.2 IN4001 RECTIFYING DIODE

In electronics, a diode is a two-terminal electronic component that conducts electric current in only one direction. The term usually refers to a semiconductor diode, the most common type today. This is a crystalline piece of semiconductor material connected to two electrical terminals. The most common function of a diode is to allow an electric current to pass in one direction (called the diode's forward direction) while blocking current in the opposite direction (the reverse direction). Thus, the diode can be thought of as an electronic version of a check valve. This unidirectional behavior is called rectification, and is used to convert alternating current to direct current, and to extract modulation from radio signals in radio receivers [12].

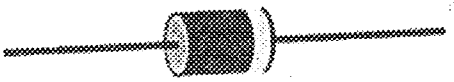


Fig.3.2 IN4001 diode

3.1.3 BRIDGE RECTIFIER

A four-diode rectifier circuit shown below serves very nicely to provide full-wave rectification of the ac output of a single transformer winding. The diamond configuration of the four diodes is the same as the resistor configuration in a Wheatstone bridge. In fact, any set of components in this configuration is identified as some sort of bridge, and this rectifier circuit is similarly known as a bridge rectifier.

The rectifier circuit requires two diodes to be forward biased in every half cycle of the input alternating voltage or current while the other is cut-off through reverse biased. Then the early cut-off diode comes active while the others are cut-off.

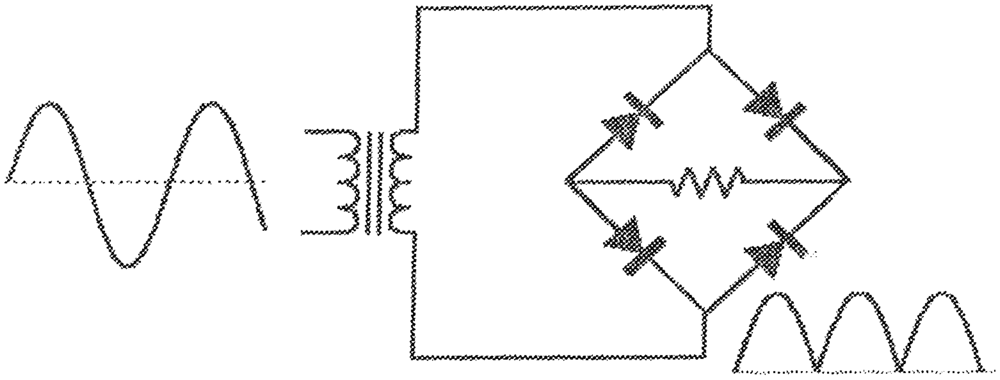


Fig.3.3 A bridge rectifier

3.1.4. LM7805 AND LM7812 REGULATOR

The LM78XX is a three-terminal positive voltage regulators employ built-in current limiting, thermal shutdown, and safe-operating area protection which makes them virtually immune to damage from output overloads. With adequate heat sinking, they can deliver in excess of 0.5A output current. Typical applications would include local (on-card) regulators which can eliminate the noise and degraded performance associated with single-point regulation. LM7812 regulates the 15V DC to 12V DC while LM7805 regulate the 12V DC to 5V DC and provide a stable power supply to the microprocessor.

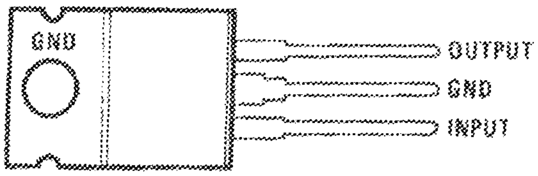


Fig. 3.3 LM78XX

3.1.5 CAPACITOR

A capacitor (formerly known as condenser) is a passive electronic component consisting of a pair of conductors separated by a dielectric (insulator). When there is a potential difference (voltage) across the conductors a static electric field develops in the dielectric that stores energy and produces a mechanical force between the conductors. An ideal capacitor is characterized by a single constant value, capacitance, measured in farads. This is the ratio of the electric charge on each conductor to the potential difference between them.

Capacitors are widely used in electronic circuits for blocking AC (electrolytic capacitor) while allowing DC or blocking DC (ceramic capacitor) while allowing AC to pass, in filter networks, for smoothing the output of power supplies,

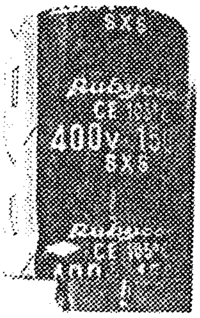


Plate 3.1.5 A Capacitor

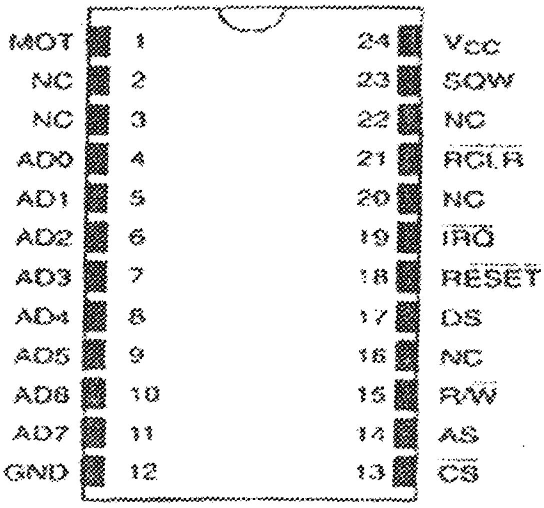
3.2 REAL TIME CLOCK UNIT (RTC)

A real time clock is an IC that can perform the function of a clock without interruption even when there is power outage and with a better accuracy, in this project the

DS12887 was employ as the real time clock because of the features it has, it's a 24 pin dual inline package with 8 data and address line that make it compatible with 8 bit microcomputer

3.2.1 DS 12887 FEATURES

- Pin compatible with other RTC and microcontroller chip.
- Totally non volatile with over 10 year's operation in the absence of power.
- Self contain subsystem including lithium, quartz and supporting circuitry.
- Ability to count seconds, minutes, hours, days, weeks, years and leap years compensation valid up to year 2100.
- Binary or BCD representation of time, days, weeks, and years.
- Day time saving time option.
- Programmable square wave output signal.
- 14 bytes of clock and control register and 114 byte of general purpose RAM.
- Need no crystal oscillator.
- Has a periodic rate of 122msec to 500msec.



24-PIN ENCAPSULATED PACKAGE

3.2.2 DS12887 PIN DESCRIPTION

MOT ------ (Bus type selection): This is pin is used to select between 8 or 4 bit bus.

NC ------ (No connection): This are pin that are excluded from manufacturer.

AD0-AD7 ---- Multiplexed address/data bus.

CS ------ (Chip select): This is used to power up and power down the chip.

AS ------ (Address strobe): A positive-going address strobe pulse serves to demultiplex the bus. Which is also known as ALE causes the address to be latched within the DS12887.

R/W ------ Read or write input

DS ------ (Data strobe): indicate when the data bus is ready

RESET ---- Used to reset the input and output

IRQ ------ (Interrupt Request Output) : The IRQ pin is an active low output of the DS12887 that can be used as an interrupt input to a processor to determine when an interrupt is present and the corresponding interrupt–enable bit is set. The RESET pin also clears pending interrupts.

Multiple interrupting devices can be connected to an IRQ bus. The IRQ bus is an open drain output and requires an external pull up resistor.

SQW ------ (Square wave output) Used to determine the frequency of the square wave output of the data bus.

VCC ------- Supply voltage which is normally +5 volt DC.

GND ------- Ground.

3.3 MICROCONTROLLER UNIT

A microcontroller is a single chip that contains the processor (the CPU), non-volatile memory for the program (ROM or flash), volatile memory for input and output (RAM), a clock and an I/O control unit. Also called a "computer on a chip," billions of microcontroller units (MCUs) are embedded each year in a myriad of products from toys to appliances to automobiles. For example, a single vehicle can use 70 or more microcontrollers. The microprocessor used for this project is AT89C52 and it belongs to the 8051 family.

The picture below describes a general block diagram of microcontroller.

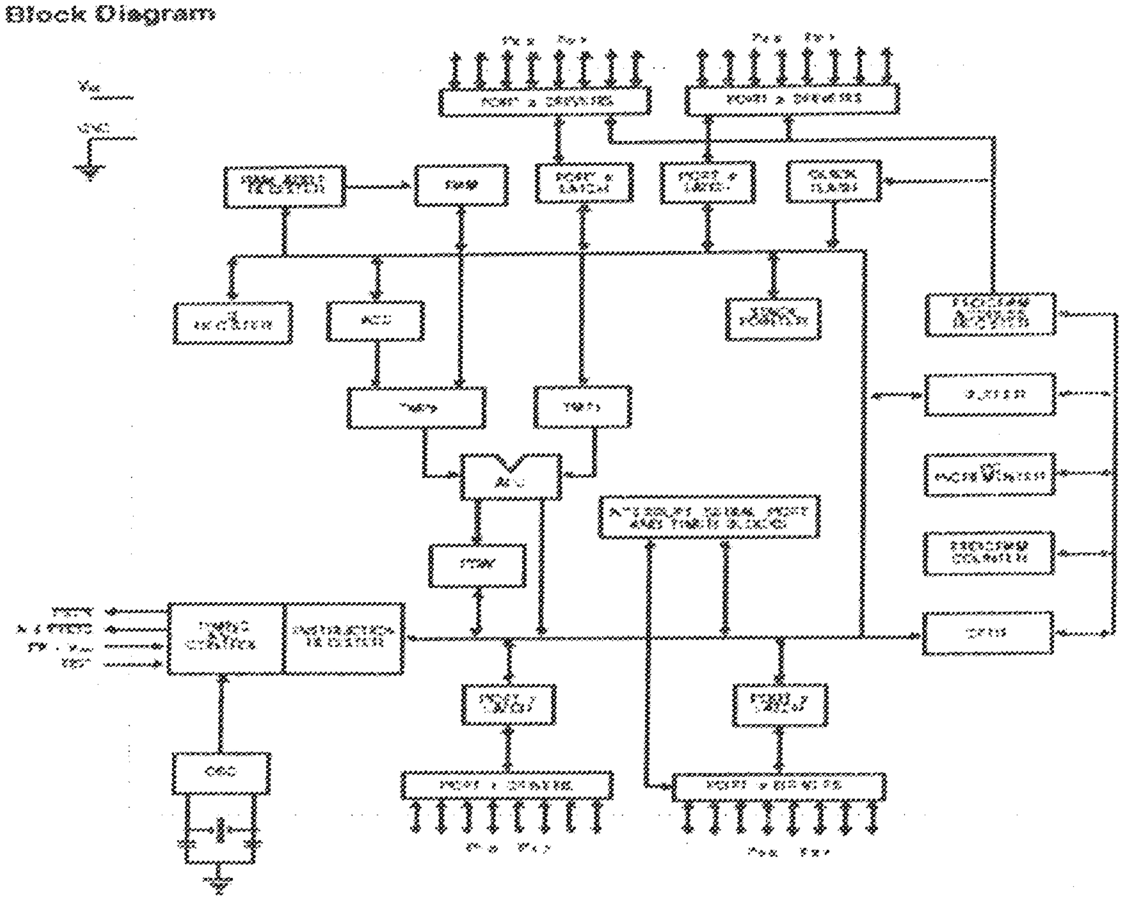
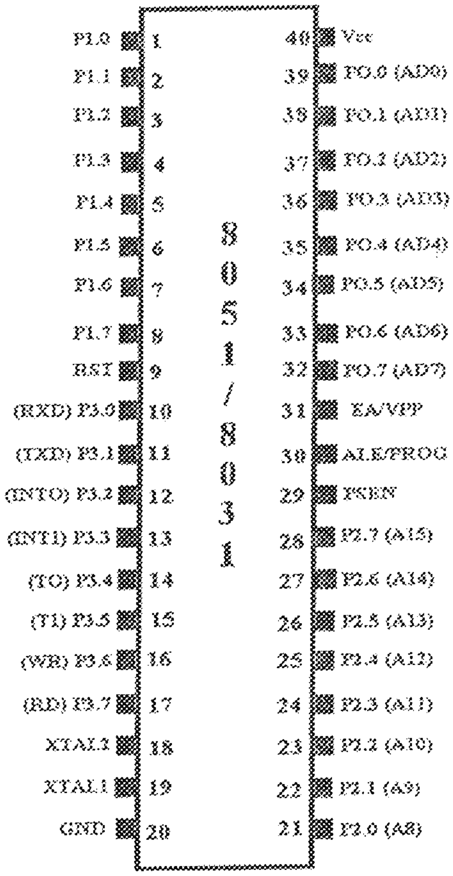


Fig 3.3

3.3.1 AT89S52

The AT89C52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 8051 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory pro-grammar. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many, embedded control applications.

The pin diagram of the 8051 shows all of the input/output pins unique to microcontrollers:



The 8051 architecture consists of these specific features:

- 16 bit PC &data pointer (DPTR)
- 8 bit program status word (PSW)
- 8 bit stack pointer (SP)
- Internal ROM 4k
- Internal RAM of 128 bytes.
- 4 register banks, each containing 8 registers
- 80 bits of general purpose data memory
- 32 input/output pins arranged as four 8 bit ports: P0-P3

- Two 16 bit timer/counters: T0-T1
- Two external and three internal interrupt sources Oscillator and clock circuits.

3.4 DISPLAY UNIT

The display unit is made up of two basic components i.e. UNL2803 and the LEDs

3.4.1 UNL2803 (Eight Darlington Array) it contain the following features

- Eight Darlington pairs with common emitter
- Output current of about 500mV
- Output voltage of about of about 50V
- Integral suppression diode
- Version for all popular families
- Output can be paralleled
- Input pinned opposite output to simplify board output

In this project the UNL2803 is used to sink current to make the LED bright and create room for paralleling of the LEDs.

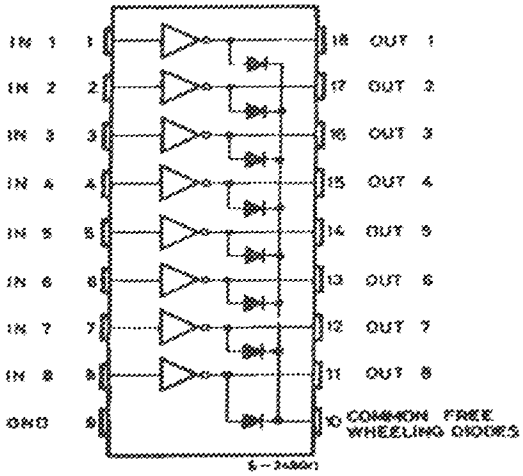
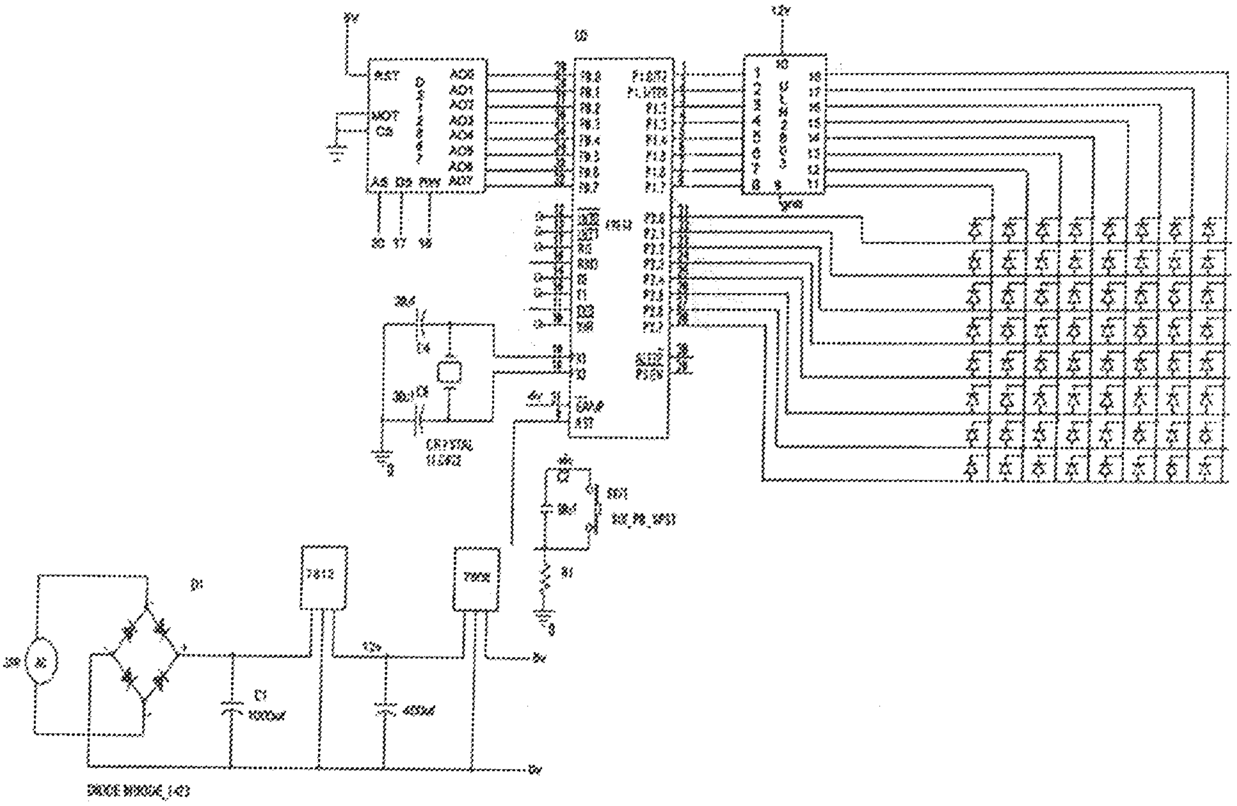
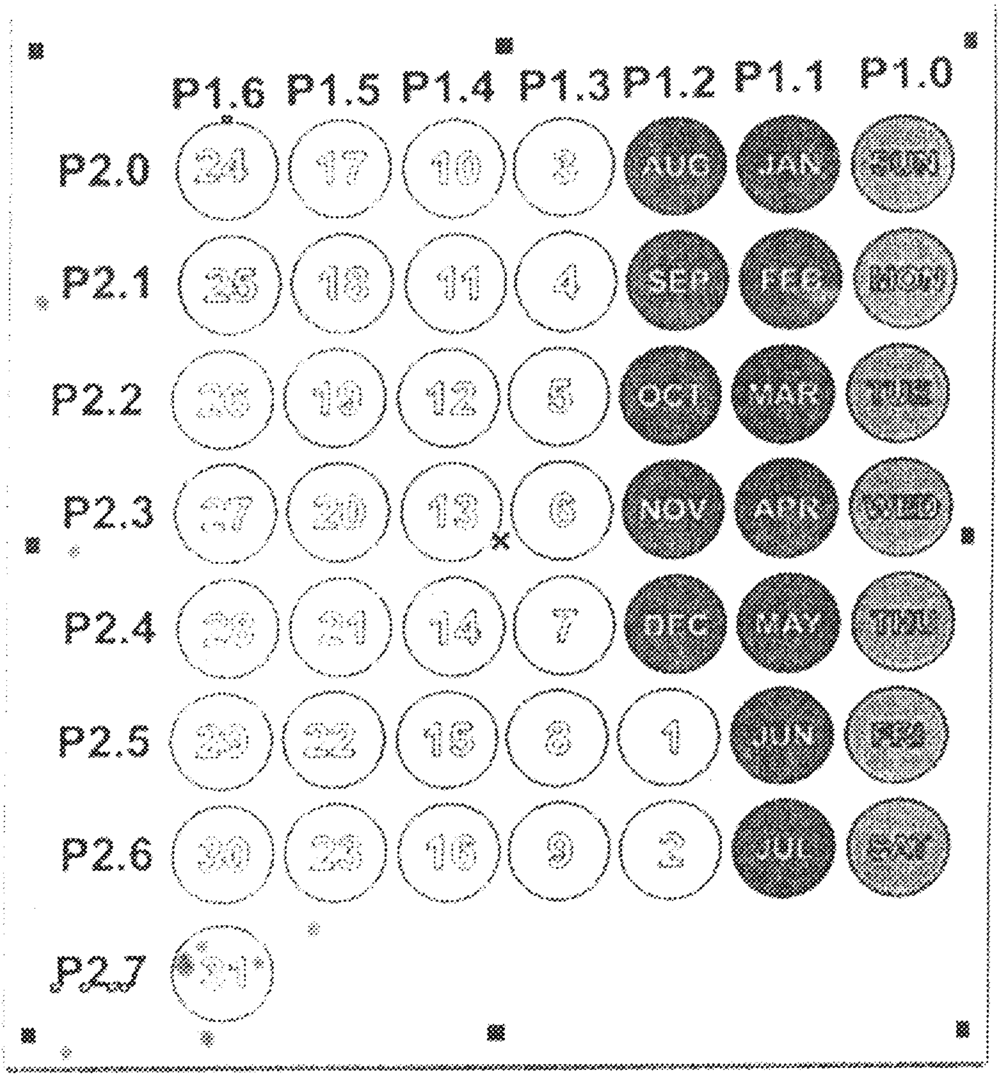


fig 3.4 ULN 2803 DIAGRAM

3.4.2. LED (Light Emitting Diode) it's a diode that emit visible rays of light when current passes through it but only operate in forward bias mode unlike other type of diodes

Main circuit diagram





	P1.6	P1.5	P1.4	P1.3	P1.2	P1.1	P1.0
P2.0	24	17	10	3	AUG	JAN	SUN
P2.1	25	18	11	4	SEP	FEB	MON
P2.2	26	19	12	5	OCT	MAR	TUE
P2.3	27	20	13	6	NOV	APR	WED
P2.4	28	21	14	7	DEC	MAY	THU
P2.5	29	22	15	8	1	JUN	FRI
P2.6	30	23	16	9	2	JUL	SAT
P2.7	31						

The RTC was connected to port 0 while the UNL2803 was connected to port1 and port 2 was used as the output from the microcontroller, the microcontroller fetch data from the RTC and display it no port 1 and port 2, using port 1 as the negative source of the LED and port 2 as the positive source of the LED

CHAPTER FOUR

TEST RESULT AND DISCURSION

4.0 CONSTRUCTION

The project was first designed on a bread board. The work was then transferred to a Vero board after achieving the desired objective. Construction, testing accuracy and measurements were carried out on each module.

During the design each module was constructed and first tested using the multimeter, for its functional abilities. The RTC circuit was tested separately before interfacing it with the microcontroller circuit and was confirmed ok.

The components were soldered on the Vero board using lead and 60W soldering iron. Jumper wires were used to connect various points together and to bridge the connection between the component sections.

Integrated circuit socket were soldered on the Vero board instead of the ICs themselves directly to avoid over –heating them during soldering and for easy replacement when necessary. Great care was taken in handling the microcontroller ICs because any form of static discharge or heat during soldering could easily damage them.

4.1. TESTING AND RESULTS

Digital Multimeter is the main instrument used in carrying out tests. The output power of the rectifier stage was measured. The output voltage of the regulator ICs i.e. 7805 and 7812 was measured to be approximately 5V and 12V respectively. All other components of the circuit were also measured and appropriate values were ensured.

Testing the Real Time Clock: The RTC was been tested using a special sub routine which configures the RTC for the first use and for a particular day which was set as the default day, time, date and month. Since the RTC is totally non volatile with over 10 year's operation in the absence of power which make the digital calendar very accurate and effective.

Different days was tested to confirm the efficiency of the RTC

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.0 CONCLUSION

The design and construction of microcontroller base digital calendar was successfully achieved. This design was particularly made to ensure effective counting of days and month. It is worth mentioning how interesting it is when one designs and constructs a system and see it function satisfactorily. This project has also improved on my knowledge and understanding of practical design and construction, especially on the use of integrated circuits(IC) in digital system. The prototype of the digital calendar was efficiently designed, constructed and tested. This prototype has facilities to be integrated with an electronic display thus making it truly calendar.

Some problems were however encountered such as component malfunctioning, this was corrected after much trouble- shooting and the non-availability of some components in the market which led to their replacements.

Conclusively the use of this digital calendar could be enjoy in home, hotels, schools, offices and shops whose operation is not based on sentiments.

5.1 RECOMMENDATION

This design is recommended for homes, offices, banks, hotels etc for counting of days , month and year purposes. There is room for further improvement to achieve better performance.

5.2 FUTURE IMPROVEMENT

The use of microcontroller in place of a general purpose computer allows us to theorize on many further improvements on this project. The digital calendar could be improved by using any reflective material as the display or using a very large LCD.

It could also be improve by using glass as the main casing.

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APENDIX A

```
DATE_RST    EQU   P1.2
DATE_CLK    EQU   P1.3
DATE2       EQU   P1.4
DATE3       EQU   P1.5
DATE4       EQU   P1.6
DATE1       EQU   P1.7
MON1        EQU   P3.0
MON2        EQU   P3.1
DSEG
ORG     20H
DATES:      DS    1
DAY:        DS    1
MONTH:      DS    1
SEL:        DS    1
TEMP:       DS    1
STACK:      DS      1        ; Stack begins here
CSEG              ; Code begins her
                  SETB P3.1
                  SETB P3.0
                  SETB DATE1
                  CLR DATE2
                  CLR DATE3
                  CLR DATE4
                  SETB MON1
                  CLR MON2
                  CLR DAY_CLK
                  CLR DATE_CLK
                  CLR MON_CLK
                  SETB DAY_RST
                  SETB DATE_RST
                  SETB MON_RST
                  NOP
                  CLR DAY_RST
                  CLR DATE_RST
                  CLR MON_RST
                  MOV SEL,#01H
                  MOV DAY,#01H
                  MOV DATES,#01H
                  MOV MONTH,#01H
FVB1:       CJNE A,#02H,FVB2             ;date
DCD2:       INC DATES
                  MOV A,DATES
                  CJNE A,#01,CVS1
                  SETB DATE_RST
                  NOP
                  CLR DATE_RST
                  SETB DATE1
                  CLR DATE2
                  CLR DATE3
                  CLR DATE4
```

```
                AJMP DDVN
CVS1:       CJNE A,#11,CVS2
                SETB DATE2
                CLR DATE1
                CLR DATE3
                CLR DATE4
                AJMP DDVN
CVS2:       CJNE A,#21,CVS3
                SETB DATE3
                CLR DATE1
                CLR DATE2
                CLR DATE4
                AJMP DDVN
CVS3:       CJNE A,#31,CVS4
                SETB DATE4
                CLR DATE1
                CLR DATE2
                CLR DATE3
                AJMP DDVN
CVS4:       CJNE A,#32,DDVN
                SETB DATE1
                CLR DATE4
                CLR DATE2
                CLR DATE3
                CLR DATE_CLK
                SETB DATE_RST
                NOP
                CLR DATE_RST
                MOV DATES,#01H
                AJMP DSD2
DDVN:       SETB DATE_CLK
                CALL DELLAY
                CLR DATE_CLK
DSD2:       AJMP UPO
FVB2:       CJNE A,#03H,DSD2          ;month
                INC MONTH
                MOV A,MONTH
                CJNE A,#01,CVS91
                SETB MON_RST
                NOP
                CLR MON_RST
                SETB MON1
                CLR MON2
                AJMP DADVN
CVS91:      CJNE A,#11,CVS92
                SETB MON2
                CLR MON1
                AJMP DADVN
CVS92:      CJNE A,#13,DADVN
                SETB MON1
                CLR MON2
                CLR MON_CLK
```

```
                SETB MON_RST
                NOP
                CLR MON_RST
                MOV MONTH,#01H
                AJMP UPO
DADVN:      SETB MON_CLK
                CALL DELLAY
                CLR MON_CLK
                AJMP UPO
HJ3:        CALL HDAY_DELAY
                INC DATES
                MOV A,DATES
                CJNE A,#01,ACVS1
                SETB DATE_RST
                NOP
                CLR DATE_RST
                SETB DATE1
                CLR DATE2
                CLR DATE3
                CLR DATE4
                AJMP ADDVN
ACVS1:          CJNE A,#11,ACVS2
                SETB DATE2
                CLR DATE1
                CLR DATE3
                CLR DATE4
                AJMP ADDVN
ACVS2:          CJNE A,#21,ACVS3
                SETB DATE3
                CLR DATE1
                CLR DATE2
                CLR DATE4
                AJMP ADDVN
ACVS3:          CJNE A,#31,ACVS4
                SETB DATE4
                CLR DATE1
                CLR DATE2
                CLR DATE3
                AJMP ADDVN
ACVS4:          CJNE A,#32,ADDVN
                SETB DATE1
                CLR DATE4
                CLR DATE2
                CLR DATE3
                CLR DATE_CLK
                SETB DATE_RST
                NOP
                CLR DATE_RST
                MOV DATES,#01H
                CALL INC_MONTH
                CALL DAY_DELAY
                RET
```

```
ADDVN:          SETB DATE_CLK
                CALL DELLAY
                CLR DATE_CLK
                INC DAY
                MOV A,DAY
                CJNE A,#08H,BNA1        ;chk for day is 8
                SETB DAY_RST
                NOP
                CLR DAY_RST
                MOV DAY,#01H
                AJMP UPO1
BNA1:      SETB DAY_CLK
                CALL DELLAY
                CLR DAY_CLK
                AJMP UPO1
UPO1:      CALL DAY_DELAY
                AJMP THIRTYONE
Drt:            INC DATES
                MOV A,DATES
                CJNE A,#01,CACVS1
                SETB DATE_RST
                NOP
                CLR DATE_RST
                SETB DATE1
                CLR DATE2
                CLR DATE3
                CLR DATE4
                AJMP CADDVN
CACVS1:         CJNE A,#11,CACVS2
                SETB DATE2
                CLR DATE1
                CLR DATE3
                CLR DATE4
                AJMP CADDVN
CACVS2:         CJNE A,#21,CACVS3
                SETB DATE3
                CLR DATE1
                CLR DATE2
                CLR DATE4
                AJMP CADDVN
CACVS3:         CJNE A,#31,CADDVN
                SETB DATE1
                CLR DATE4
                CLR DATE2
                CLR DATE3
                CLR DATE_CLK
                SETB DATE_RST
                NOP
                CLR DATE_RST
                MOV DATES,#01H
                CALL INC_MONTH
                CALL DAY_DELAY
```

```
                RET
CADDVN:         SETB DATE_CLK
                CALL DELLAY
                CLR DATE_CLK
CADS            INC DAY
                MOV A,DAY
                CJNE A,#08H,CBNA1           ;chk for day is 8
                SETB DAY_RST
                NOP
                CLR DAY_RST
                MOV DAY,#01H
                AJMP CUPO1
CBNA1:          SETB DAY_CLK
                CALL DELLAY
                CLR DAY_CLK
           AJMP CUPO1
CUPO1:     CALL DAY_DELAY
                AJMP THIRTY
INC_MONTH:      INC MONTH
                MOV A,MONTH
                CJNE A,#01,ACVS91
                SETB MON_RST
                NOP
                CLR MON_RST
                SETB MON1
                CLR MON2
                AJMP ADADVN
ACVS91:    CJNE A,#11,ACVS92
                SETB MON2
                CLR MON1
                AJMP ADADVN

ACVS92:    CJNE A,#13,ADADVN
                SETB MON1
                CLR MON2
                CLR MON_CLK
                SETB MON_RST
ADADVN:    SETB MON_CLK
                CALL DELLAY
                CLR MON_CLK
AUPO:      RET

DELLAY:
           MOV R5,#0FFH
           DJNZ R5,$
           RET
DELAY:     MOV R0,#1FH
INLOP:     MOV R1,#0FFH
                DJNZ R1,$
                DJNZ R0,INLOP
                RET
                END
```