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Solar Power based Wireless Electronic NoticeBoard by Using GSM

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ABSTRACT

Now a day's every advertisement is going to be digital. In Railway stations and bus stands everything that is ticket information etc is digital moving display. As in such case the idea of our project is to develop a moving message display in classrooms to pass any information through a SMS from the mobile phones. We are using the GSM technology to access the display and solar power is used as a source for this project as the energy is stored in battery and the supply is given to the dot matrix display. If the user wants to display some message, he will send the messages in SMS format where the MODEM will receive the message and update the display according to the message. A desired text message from a mobile phone is sent via a Global System for mobile communication (GSM) to the GSM module located at receiving end. The GSM modular is connected to MAX232 Integrated circuit to the AT8051 microcontroller. This research work is developed with Microcontroller from ATMEL. The microcontroller provides all functionality of the display and wireless control.

Keywords : AT8051 MICROCONTROLLER, GSM module, DOT-matrix display

I. INTRODUCTION

In the fast developing world today, the need to control electrical appliances from far away is becoming a necessity. This project titled "MOVING MESSAGE DISPLAY" aims to convey the information from far distances whenever required by sending a SMS to the system. In this project we are taking the power through solar. The main aim is to receive and recognize the SMS sent from any location. Now-a-days advertisement is going digital, in trains and buses the information like platform number, ticket information is displayed in digital boards. People are now attracted to the idea to the technology world at its finger-tips. The use mobile phones have increased drastically over years. The GSM technology is used in this project GSM stands for Global System for Mobile Communication. Due to this GSM modular, we can send message to receiver from any part of the world. It is has the system for SMS-Short Message Service. This aims propose is for industrial applications that will utilize the distinct advantages of the GSM.SMS system over other possible technologies in the industrial setting. This project is can be mainly utilized to change or modify the message that is being displayed at any time and from anywhere within the reach of the wireless network signal. The project can also be handled in indoors or outdoors surrounding with the wide usage of LED displays is as a result of its ability to convey information to large audiences quickly and efficiently. The prototype model develops using major components

- GSM-modem
- microcontroller-at8051
- max-232 level shifter
- led dot matrix display
- current limiting resistors
- 7805 regulator

II. BLOCK DIAGRAM

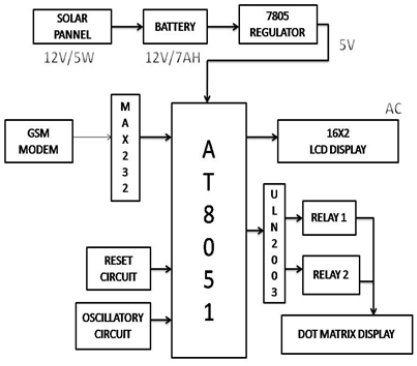

Figure 1. Block Diagram

A. Microcontroller

The microcontroller is designed to programmed in such a way that when the modem receives any message, the microcontroller will read the message form serial port and verify for the password, if the pass word is correct then it will start displaying the messages on the LED display system.LED is connected to microcontroller ,before displaying anything on the LED, initialization has to be done ,so microcontroller will control the LED initialization and select the data register and command register according to the requirement . The memory is connected to microcontroller using two pins, it is communicated with the microcontroller through communication component.

B. MAX232

The max232 is an integrated circuit which consists of 16 pins and it is mostly used in voltage levelling problems and is also used to convert the standard TTL (TRANSISTOR-TRANSISTOR LOGIC) value into RS232 and again from RS232 to standard TTL values. As the input and output voltage are TTL logic values, ie 0v and 5v but in serial communication we are using RS232 values (-3.5 to -2.5,+3 to +2.5).so a buffer driver circuit is used which is MAX232 between microcontroller and the GSM and led array. It is also known as dual driver/receiver and typically converts the CTS, RX, TS and RTS signals, these also provide voltage to external capacitors.

C.GSM-modem:

This GSM modem is mostly used in SMS control, transferring of data, remote control and logging can be easily developed. The main advantage of this is we can use its RS232 port to communicate and develop in different applications. In this project the modem is connected to microcontroller or it can be connect to computers. It is also used to send and receive SMS or make/receive voice calls. Global Packet Radio Service (GPRS) is also an extension of GSM that enables higher data transmission rate where the modem is assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for microcontroller.

D. Power Supply

At starting stage it provides required power to drive the whole system. The specification of power supply depends on the power requirement and this requirement is determined by its rating. In this project the power is taken through solar panel.

E. 7805 Voltage Regulator:

Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements it generates a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions. Voltage regulator is a device that automatically maintains a voltage at constant level.

F. ULN2003 (transistor):

It is a high voltage and high current Darlington array IC, In this project ULN 2003 belongs to the family ULNX series of integrated circuits. Different versions of this family conjugate to different logic families.ULN2003 is for 5V TTL, CMOS, PMOS/NMOS logic devices it is used in stepper motor and in driving a wide range of loads and are used as relay drivers, display drivers, line drivers etc.

G. LCD (Liquid Crystal Display)

IT is an electronic device used for displaying text or characters. We are using 14 pin LCD, 16*2 represents 16 characters and 2 line display. LCD's are economical and easily programmable and can easily display special and any characters.

Detailed explanation of pins:

- Pin 1-This is VSS -ground pin.
- Pin 2-This is VDD it is called power supply pin
- Pin 3-This is short pin
- Pin 4-This is RS it is register select pin
- Pin 6-This is E it is enable pin
- Pin 5-This is R/W it is Read/Write pin
- Pin 7 to pin 14-All 8 pins are responsible for the transfer of data.

H. EPROM

Here this memory device is used to store data (offline). It provides 2048 bits of serial electrically erasable and programmable read only memory (EEPROM) organized as 8192 words of 8 bits each. This device is mostly used in industries and commercial applications where low power and voltage is used for operation. This EEPROM will be communicating with the microcontroller using 12C communication it contains one data pin and clock pin, these device are connected as slave to the microcontroller, The main usage of this system is to store the message coming from user mobile, when the microcontroller is doing the operation of writing and reading to memory.

I. Dot matrix display

In the dot matrix display multiple LED'S are wired together in rows and columns this is required to less the number of pins. In this dot matrix display the LED's will not glow continuously but they are lid in a order by scanning "vertical strobe" or "horizontal strobe". In the vertical strobe mode, information is passed to the display by selecting a single row at a time which energizes the LED's and then proceed to the ext row where 'as in horizontal strobe mode, a single column is chosen at a time, This method is for the better brightness of display and less economy in hardware. In this project 7*8 matrix of LED is considered i.e. 56 input pins for each LED by wiring all anodes together in row and cathode in column then the required number of input pins are reduced and all the LED'S are addressed by their own row and column, the model requires column and row configuration with data signal on column and row are scanned.

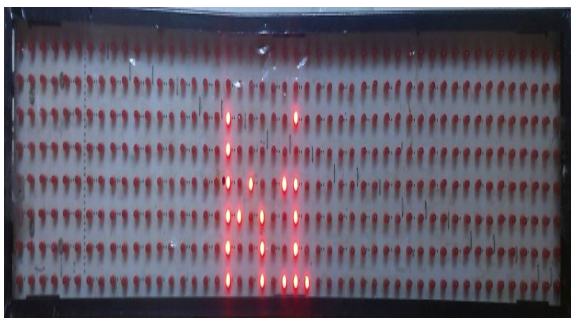

Figure 2. LED Display

III. INTERFACE OF CONTROL UNIT AND OTHER COMPONENTS

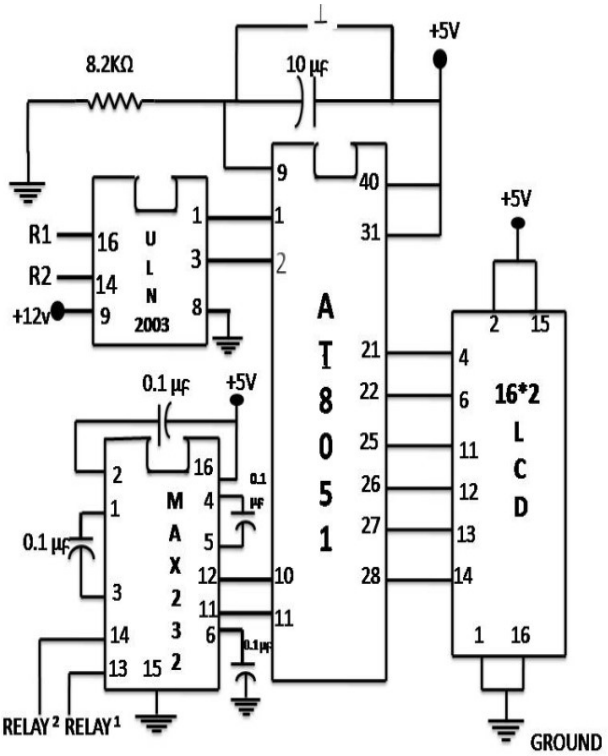

Figure 3. Interfacing of microcontroller

IV. DESIGNING OF ELECTRONIC NOTICE BOARD

The display system is aimed at class rooms for displaying information at regular interval during in working hours also, it consist a GSM MODULE which acts as a receiver and can be handled through any mobile phone. the control unit receives the message from the transmitter and it validates the message through a mobile identification number(MIN) and display's the information on the DOT MATRIX DISPLAY board. The major components are GSM module, AT8051 MICROCONTROLLER,8*48 character led display matrix form, max 232.when a text message is sent from mobile phone to the GSM module it responds for the requesting message as the module has different voltage level the voltage regulator is used synchronize the voltage level from the controlling unit, The data which is coming from module it is stored in EPROM(external memory) and is fetch by the main unit and directly fed to the shift registers and then the message is displayed on the dot matrix display. we can also connect 2 microcontrollers to increase the speed processing and to display new message as fast as possible by reducing time between receiving and displaying the message. By using this SMS service it is possible to change the message from anywhere in the world as it is wireless based the handling of the message is very easy rather than using pc's.

The methodology for reading the message from the modem:-

The GSM module feds with microcontroller through a asynchronous serial communications, at the starting stage of initialization for the execution of program in the microcontroller through the values of SCON (serial port control register), THI AND TMOD (time mode control) are set. The microcontroller sends some set of AT commands. To show the message by the user those AT commands are known below:

AT- Initialize the modem (attention)
ATE0- to off the echo
AT+CMGF- to set message format to text
AT+CNMI- to show the new message
AT+CMGR- to read the message
AT+CMGD- to delete the message
For the first 3 commands the modem responds with microcontroller with the commands 'ok'. after the execution of the last AT command the GSM modem responds with the long command

The microcontroller only keeps the current message and avoids the older one the older messages are stored in buffer array which is used to display on LED array.

The DOT matrix board displays the characters in order (5*7) characters that move from left from right, there are more than 6 shift registers are used to scroll the message each shift register displays the character on 7rows and 8 columns after this it changes the momentum to the next shift register displaying the total of 7 rows and 48 columns. Shift registers and DOT matrix display are combined such a way that when data is received from the control unit, it passes to serial communication through serial data.

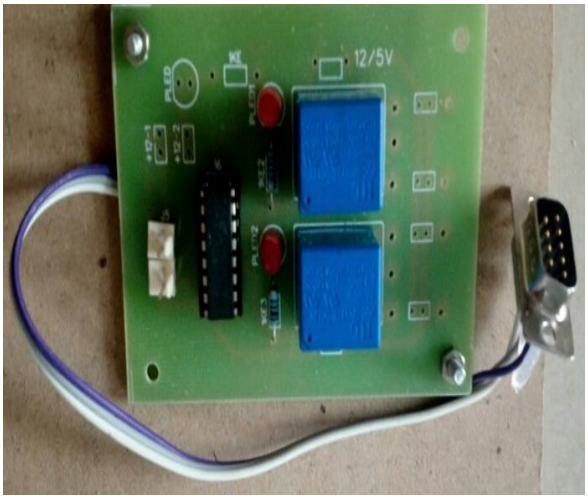

Figure 4. Connection of Relay's with the DB9 male connector.

The power supply unit considered is DC source which is taken through solar pannel i.e. 12 volts 5 watts,therefore the major components in power suppy is solar pannel,battery.

V. DESIGN OF FLOW CHART

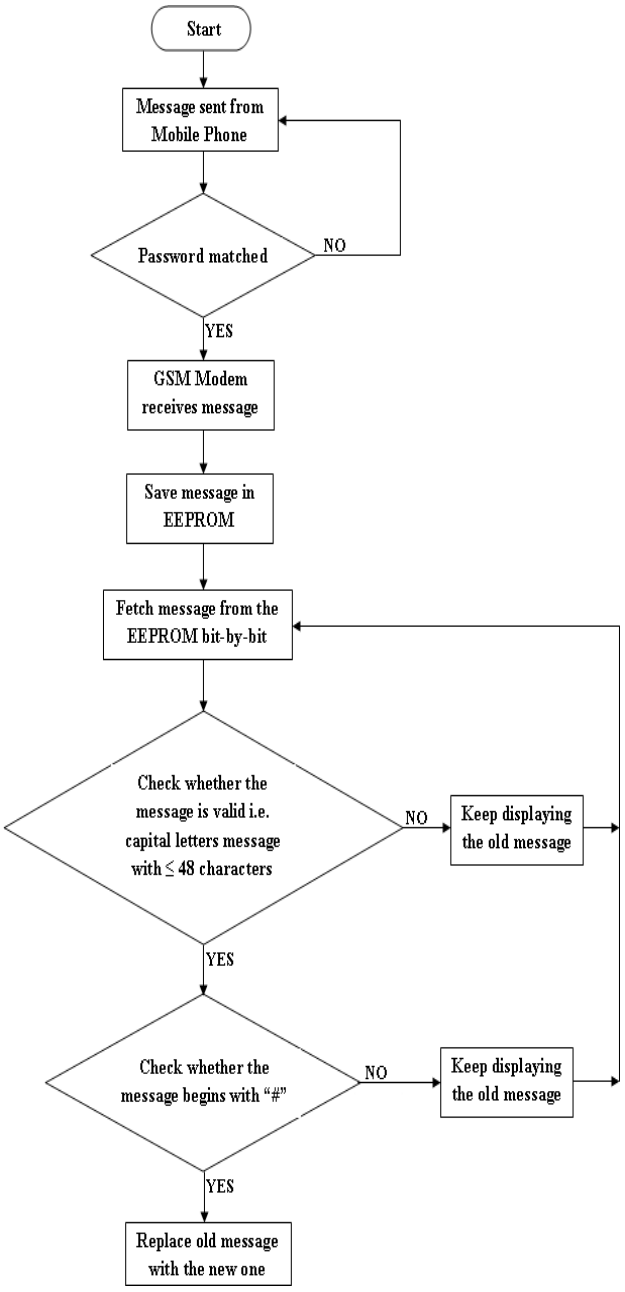

Figure 5. Operation of flow chart

The above flow chart is shown for the GSM based moving DOT matrix display board When the message is sent from the mobile the GSM module receives it by checking code for certain message if yes then the message will be saved to external data i.e. EEPROM, after saving to EEPROM ,it Fetches the message bit by bit and checks the limitation or the maximum of the characters to be display, in this process it displays the

previous messages and the new message will be replaced when the message is sent with the starting of the code(*data#).

VI. COMBINATION OF SHIFT REGISTERS WITH DOT MATRIX DISPLAY

The use of shift register minimizes the number of input pins which required to drive the every column of the led matrix. In shift register the data is entered through the serial data and the serial data is entered through a 2 input and gate, synchronous with a low to high transition of the clock

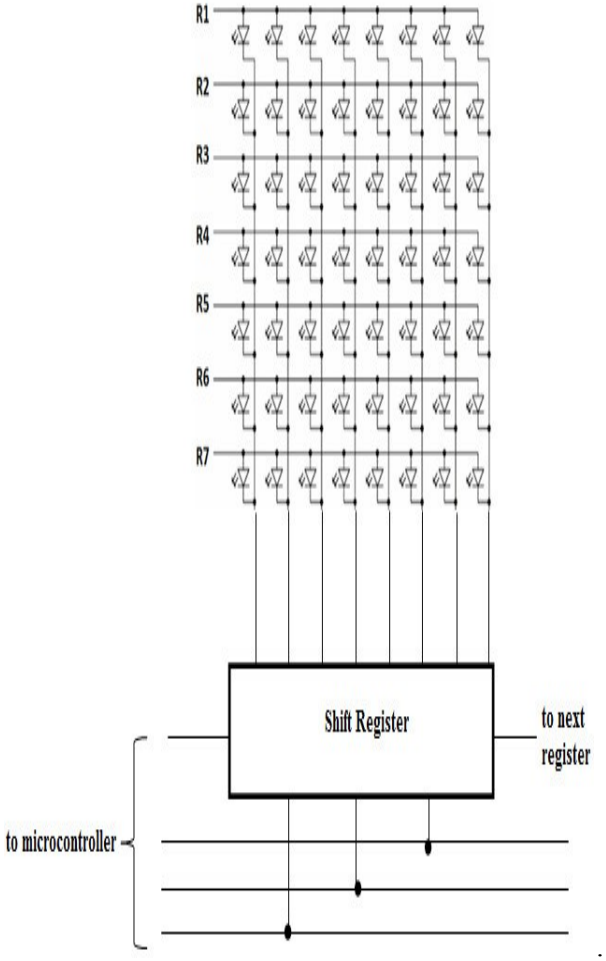

Figure 6. interface of shift register with dot matrix display

The DOT matrix board displays the characters in order(5*7) characters that move from left from right, there are more than 6 shift registers are used to scroll the message each shift register displays the character on 7rows and 8 columns after this it changes the momentum to the next shift register displaying the total of 7 rows and 48 columns. The shift register and DOT matrix display are combined such a way that when data is received from the control unit, it passes to shift register through serial data next it passes to internal register of the shift register by using its own serial clock of shift register. In the above figure we can see the output and data in parallel format are activated by a latch clock.

VII. PIN DESCRIBTION OF 8051 MICRO-CONTROLLER

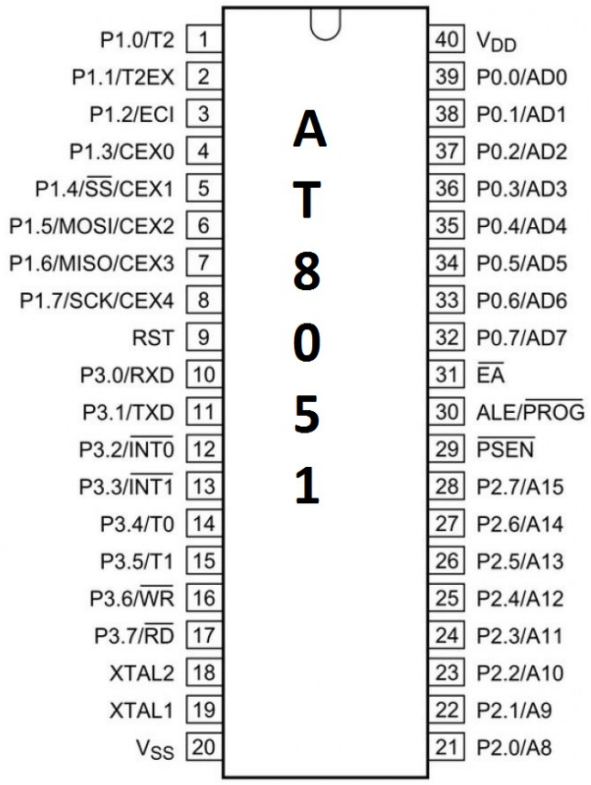

Figure 7. Pin diagram of 8051

- PIN (1-8) : Port1 has address of 90H. It is a pure data bus. The pins are denoted as P 1.0, P 1.1 P 1. PIN 9 (Reset Pin) : A high to low pulse enable the micro controller to access the program from ROM to RAM.
- PIN (10 – 17) : Port 3 address is BOH. This port is also used for some special functions. Those are
  P 3.0 - Receiver for serial communication

  P3.1- Transmitter for serial communication.
  Ex- GSM, GPS.

  P 3.2 - External interrupt zero (0)
  P 3.3 - External interrupt one (1)
  P 3.4 - Timer interrupt zero (0)
  P 3.5 - Timer interrupt one (1)
  P 3.6 - Write strobe
  P 3.7 - Read strobe

- PIN (18 – 19): Crystal oscillator input and output pins. If the frequency of crystal oscillator is equal to the internal frequency of micro-controller. The frequency range is 0-24 MHz
- Then it will form a resonant circuit from that we can get the clock pulses we can synchronize the all internal operation of micro controller.
- PIN (21 – 28) : Port 2 address of port 2 is AOH. The pins are denoted as P2.0, P2.1, --------P2.7. it is used as A8 – A15 when external memory is used for store the program code.
- PIN 29: PSEN – Program store enable.
- PIN 30: ALE - Address Latch enable.
- PIN 31 : EA pin external access pin it indicates weather program is stored in the internal memory or in the external memory.
  If EA = 0 - External Memory
  If EA = 1 - Internal Memory.
- PIN (32 – 39) : Port 0 address is 80H . The pins are P0.0, P0.1,----------P0.7. It is used as lower byte address bus A0 – A7 when external memory.
- PIN 40: Vcc: - Supply voltage.
- PIN 20: Vss: - Circuit ground potential.

VIII. IMPORTANCE OF MICRO-CONTROLLERS RATHER THAN PC'S

A. To meet the computing needs of the task efficiently and cost effectively.

B.Speed the amount of ROM and RAM, the number of I/O ports and timers, size, packaging, power consumption.,easy to upgrade, Cost per unit

C.Availability of software development tools Assemblers, debuggers, C compilers, emulator, simulator, and technical support.

D.Wide availability and reliable sources of the microcontrollers

- It is a 8-bit CSIC (complex instruction set controller).
- Its operating voltage is +5V DC.
- It has 8KB of flash reprogrammable memory, 256 bytes of internal memory.
- It consists of 32 I/O pins those are divided into 4 ports.
- Full Duplex serial data transmitter and receiver.
- Two 16 bit timers and in- built oscillator circuit.
- 64KB of external data memory space

IX. CONSTRUCTION OF CONTROL UNIT

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Figure 8. construction of major components

The above PCB(PRINTED CIRCUIT BOARD) was constructed by major components like,40 pin microcontroller ,7805 regulator, bridge rectifier,100micro farad capacitor, a resistor and a light emitting diode with a LCD display, etc.

Figure 9. construction of major components

The interface of MAX 232 with microcontroller , as it is serial communication it has one transmitter and one reciever it is mainly used to convert signal from RS-

232 serial port to signals suitable for use of TTL-compatible digital logic circuits.The connections are also made with LCD display,the 14 pin LCD is connected to the printed circuit board to display the special characters, so whenever a message received to the GSM module it appears on LCD and next to theLED array board.

X. WORKING OF NOTICE BOARD WITH GSM MODULE

The following steps were taken in connecting the GSM MODEM to the notice board:

A. A sim card was installed in the GSM modular through sim slot.

B.A felmale data bus(DB9) of GSM modular is connected to the male DB9 cable,where male DB9 is the connected to one end of notice board.

C.When the supply was plugged in to GSM modem a red light glows which indicates modem is on position.

D.The modem automatically searchs for network through antena which is installed near sim slot.

E.As the MODEM was connected to notice board,the notice board does'not show any moving message but when adaptor is connected to it then it passses power to adaptor but not to the notice board directly.

F.The notice board will be on when power passes through adaptor and the message immediately start to move from left to right in the notice board.

G. The message was started with a *DATA# character in order to distinguish it from unwanted

H. Messages and consequently, prevented unwanted messages to be displayed on the board. The

I. Message was also in capital letters for the purpose of compatibility with the program burnt in the

J. Microcontroller IC. The display board was only able to display a maximum of 48 characters due to the size of the EEPROM which was only 1024 bits or 1 Kbyte.

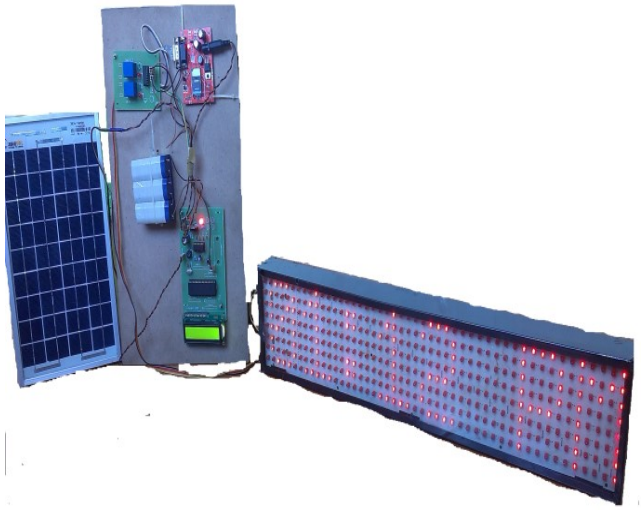

Fig 10: implementation of Solar Power based Wireless Electronic Notice Board by Using GSM

XI. CONCLUSION & FUTURE SCOPE

XII.

When we send SMS to the SIM card number which is in the GSM modem, after receiving the SMS GSM modem sends, Index number [Memory location in SIM card] as response to the microcontroller unit. Based on the index number we have generated advanced technology commands (AT + CMGR) and send them serially to modem to get the message. After receiving the message we have to check for the number, whether it is valid or invalid. If the number is valid, based on contents or commands stored in the message we will control the devices using some microcontroller to which some hardware components are interfaced to control the devices. The hardware components used in this project are ULN2003 I.C, Electromechanical switches (Relays), diodes, Capacitors, resistors, MAX232 IC for serial communication, LCD, LEDs, GSM modem, AT8051 micro controller, power supply of 5V for micro controller board and 12V for GSM modem.

Some of the pins of the microcontroller are left unused & hence can be use in the future by defining the functions. We can control many devices by increasing the ULN2003 IC's (which are connected to the microcontroller) this project can be implement for the industrial purposes also.

By interfacing ADC0808 to microcontroller we may achieve security in case of

A. Fire accidents

B. Poisonous gases

This system will act according to the parameters given by the user.

XIII. ACKNOWLEDGMENT

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