Solar Panel Based Bluetooth Controlled Led Matrix Message Display

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ABSTRACT: In this paper a display designed that will work with the help of solar energy which is very much useful in rural areas and in railway stations. The display is formed with the help of four 8*8 dot matrix displays so the information will be clearly displayed. The main power source is obtained by solar panels which convert solar energy to electrical energy. The power consumed will be obtained by solar energy so that the remote areas and all applications can easily use this display. A 2000 Mah battery will be used to store some energy when the sunlight is not available. A micro controller will be used to control the display and the Arduino will help to run the whole project. In future we can add some more features like sensors, error notification displays etc.
KEYWORDS: Matrix, Sensor, Solar Energy, Solar Panels, Microcontroller, Arduino.

I. INTRODUCTION

In this era of technology, the technology is controlling every aspect of life, which makes our life easy and enjoyable. the latest step in this era is to save energy and to save the environment. The foreign countries are developing some projects to save the environment and to save the power. In USA the solar energy is used to move trees and they ix their fertilizers with the machine which works with solar energy. This project will be the next project like using solar energy in transport systems.It's a simple 32*8 led based matrix display which is formed by four 8*8 led matrices. This display will show the information which will be given through the Bluetooth. The power supply will be produced by the solar panels which convert solar energy into electrical energy. The dc-dc converter will help us to change the converted solar energy to pure electrical energy [DC]. the dc converter will store the energy in batteries with the help of charging module. And will be used for Arduino using an usb port and cable. We think this system will be useful in rural areas where there is

less electricity and, in the metros, and trains where led display will be used. So that we can save some energy and save the environment.

The system is divided into two parts energy converting part and display part. Energy converting part: this part consists of 4 items solar panels, dc converter, charging module and batteries. The solar panels convert energy and send through dc converter to get pure power and charge into batteries with the help of charging module.

Display unit: this part consists of 3 items Arduino, Bluetooth and LED Display[3]. The code uploaded into Arduino will be read by micro controller and send the instructions to the Bluetooth and display. The word send to Bluetooth will be read by Arduino and sent to displays ic called max7219. The max ic will send the information that which part of led will glow and which part will not glow.

The methodology to develop the system is described as fallows. The development progress includes design of pattern, code and display interfacing, solar panels connectivity.

DESIGN OF PATTERN: At the very beginning we have designed the pattern of project about which parts are required and how we are using the parts to complete the project. The Arduino app is useful to upload the code into Arduino uno on which the project is based on. The max7219 ic is helping us in define the patterns of led matrix[1]. Using Arduino is very simple first we have to connect Arduino to laptop using Arduino cable then open Arduino app and upload the code, make sure that the port and Arduino model is selected in application. Now upload the code in to Arduino uno check weather its working or not, if any errors are present in code rectify them. Now check the led screen that it displays the info that sent to Arduino.

DESIGN INTERFACING WITH ARDUINO:
The Bluetooth module is used to reduce the effort

and make the project wireless. Data is easily transferred through application in mobile connected with Bluetooth in mobile. The power required for BT module is obtained from Arduino uno Through jumper wires[2].The information transferred through application will be send to Arduino. And Arduino will send the information to matrix and the max ic will read and make the matrix work.

BLUETOOTH FEATURE: Most of home entertainment components such as stereos, televisions, and home Entertainment centers use Bluetooth feature. The radio waves are used to transfer the information over short distances in sender and receiver format, which is invisible to human eye. When the information sends through application, it converts into radio frequency and send through sender and the Bluetooth receiver receives and converts radio frequency into binary code and pass the information. The range of Bluetooth is 10 meters. To avoid disturbance, maintain the distance is less than 10 meters.

CIRCUIT DIAGRAM: The photos show the circuit diagrams of display unit and energy conversion unit. We have used Arduino uno, BT module, Solar panels, DC converters, LED matrix, usb cables of type c and micro b pins. Jumper wires, charging module, mobile phones.

Figure: 1 Proteus Design of project

In block diagram 1 we can see that the connections are made from Arduino to led matrix and Bluetooth module as goes: vin pin of Arduino is connected to the power supply gnd pin of Arduino is connected with gnd pins of module and led. 5v pin of Arduino is connected with vcc pin of module and led. din pin of led matrix is connected to pin 12 in Arduino. clk pin of led matrix is connected to pin 11 in Arduino. cs pin of led matrix is connected to pin 10 in Arduino. txd pin of module is connected with txd pin of Arduino. rxd pin of module is connected with rxd pin of Arduino.

In block diagram 2 we can see that the connections are made from panels to battery as goes: the positives of all solar panels are combined to form one positive wire and connected to dc setup boosters positive slot. the negatives of all solar panels are combined into one negative wire and connected to the dc setup boosters negative slot. form dc setup booster to battery we can connect to tp4056[battery charging module] using cable. from tp4056 to batteries as positives to positives and negatives to negatives manner.
 Note: from batteries to Arduino, we can connect it through another dc booster pin and with help of usb cable provided with Arduino we can get power from batteries.

Figure:2 connections from solar panels to arduino

Figure:3 connections between led matrix, Arduino, BT module

EXPERIMENTATION: The aim of the project is to interface an Arduino Uno board with an 8 x 8 LED matrix to display information. Even though a single 8 x 8 LED matrix with corresponding MAX 7219 IC is used in this project, multiple LED matrices can be connected in series for long scrolling display. Connect the components as shown in the circuit diagram. The working of the

system is as follows. 3 of the 14 available digital input / output pins are used to control the display driver IC MAX 7219. The 3 pins on the MAX7219 IC are clock, data in and load. A maximum clock frequency of 10MHz can be applied. DIN (Data in) accepts the serial data from the microcontroller or Arduino board.

It is 16 bit long where the first 8 bits (D0 – D7) are for driving the columns SEG A-G and DP of the MAX 7219 IC of the LED matrix and the next 8 bits (D8 – D15) are for driving the rows of the LED matrix. The load pin (or CS or chip select pin in case of Max 7221 IC) latches the serial input data on its rising edge.Another important pin on MAX 7219 is the ISET, which sets the peak current to the segment to drive all the LEDs. It is connected via a resistor (R1), which is called RSET. The capacitors filter out any noise in the supply.

When the serial data in is sent using the Arduino through the program. the serial data is converted into segments and digits to drive columns and rows of the LED matrix. According to the data sent, the corresponding LEDs on the matrix light up and display the message.

The program written here is for scrolling text display. It might be difficult to view long scrolling data on a single 8 x 8 LED matrix. Hence, multiple LED matrices can be chained to form a long matrix.

The no. of MAX 7219 ICs are equal to the no. of 8 x 8 LED matrices. In order to extend the display to multiple LED matrices, the Data OUT (DOUT) pin of the first MAX 7219 must be connected to the Data IN (DIN) pin of the second MAX 7219 IC. This process must be continued for multiple LED matrices.

Controlling 8×8 LED Matrix through Android App

A dedicated app for Android based devices is designed for this project. The layout of the app which is already installed on a mobile phone. The app has 8×8 squares each corresponding to one LED on the 8×8 LED Matrix, a Reset button and a Disconnect button. Touching a particular square will turn ON the particular LED in the 8×8 LED Matrix. The color of the square will turn Red, as an indication that the LED is turned ON. Touching the square once again will turn OFF the corresponding LED and the color of the square will revert back to Grey. A Reset button is given at the bottom, using which you can reset the 8×8 LED Matrix i.e., all the LEDs will be turned OFF. The disconnect button will get disconnected from the Bluetooth.
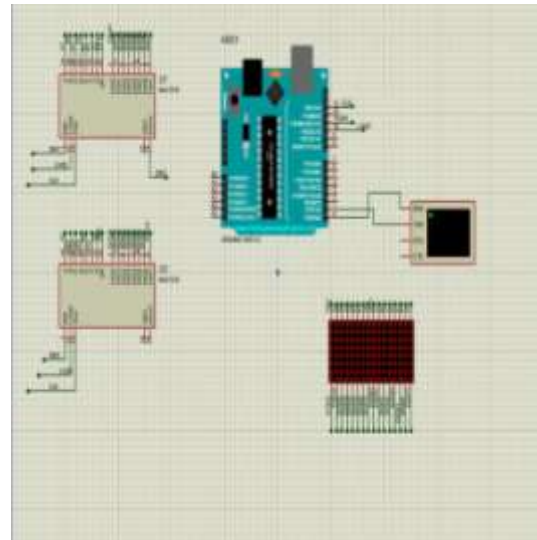

FIGURE-4: Proteus design of display unit

Programming and implementation:
This section represents the programming and practical implementation of our system.

Programming: the programming for Arduino is available in the site including BT version, we can get the code form the Arduino site. By using the program of BT version we can simply display the words on matrix, here are some samples shots below where we printed hello, world, Arduino.

Implementation: finally, the system is implemented in LED matrix and proteus we have implemented a stimulator design of display unit. The system is working properly. Some snap shots of the implemented system is shown below.

Source Code For The Microprocessor:
```
#include <LedControl.h>
int DIN = 12;
int CS = 10;
int CLK =  11;
int row=0;
int col=0;
int temp=0;
int data=0;
LedControllc=LedControl(DIN,CLK,CS,1);
void setup()
{
lc.shutdown(0,false);
lc.setIntensity(0,5);
lc.clearDisplay(0);
Serial.begin(9600);
}

void loop()
{
   if(Serial.available() > 0)
```

```
  {
    data = Serial.read();// it returns ascii value if we
send   one   in   the   phone
    if(data < 96)
    {
    if(temp==0)
    {
     row=data-48;
     temp=1;
    }
    else
    col=data-48;
    }
    else if(data=='n')
    {
     lc.setLed(0,row,col,true);
     Serial.println('n');
    Serial.println(row);
    Serial.println(col);
     temp=0;
    }
    else if(data=='f')
    {
     lc.setLed(0,row,col,false);
     Serial.println('f');
     Serial.println(row);
     Serial.println(col);
     temp=0;
    }
 else if(data=='r')
 lc.clearDisplay(0);
    }
}
```

MERITS:

A. **User friendly**:
 Messages are only to be typed on a mobile or a computer, which in turn are displayed wirelessly on the display unit.

 B. **Eliminates use of printers**:
Since we don't use papers to display information, printers are also of no use in this system.

C. **Faster means of transferring information:**
There is no delay in transmission of information. Messages are displayed in a matter of seconds after typing.

D. **Future Enhancement**: A commercial model can be able to display more than one message at a time.

• In our system we are using solar energy and Bluetooth network to display on led matrix, the same things can be used to

FIGURES 5 &6:
SOME RESULTS OF DISPLAYING
NAMES USING BT MODULE

II. CONCLUSION :

This model can be used very efficiently in establishments like hotels, railways, universities, etc. The information will be shared through display with in no time, it is cost efficient system and easy to handle. This project will save the environment by using solar energy. the information shared is only updated by authorized persons. This project can be used anywhere as it based on wireless communication. Its dynamic message display nature makes with feasible for use in every field where the content keeps of change like stock exchange, railways, airports, restaurants, etc. The major advantage of this project is advertising as the display board can be placed any height, there is no requirement of wires to communicate and no requirement of power connection. We think that this project will save energy and help to start using clean energy and make the world work on interesting things like using pure energy like pseudo energy, wind energy, water energy, etc.

III. APPLICATIONS:

• Arduino based 8 x 8 LED matrix display uses only 3 pins of the Microcontroller. Hence, it can be used in applications where displaying information is a part of the system in which other pins of the microcontroller can be used for other peripherals.

- LED Matrix is a basic form of display device that is used for displaying information at public places like bus or train stations.
- Multiple LED matrices can be combined to form large displays and can be used to display images with multi colors.
- These are also used at restaurants, railway stations, bus stands....etc.

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