ROTATING DISPLAY

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Abstract- **The paper focuses on the unit created to display any length of text using the principle of 'PERSISTENCE OF VISION [1] [9]' in a power efficient manner. The unit uses a motor to create a scrolling effect required to display text visible from any side. The use of a fewer number of LEDs also make the method energy efficient as compared to existing methods.**

I. INTRODUCTION:

Energy crisis [4] is of a much concern nowadays, as the major source of electrical power is still thermal power [6], which runs on mine coal [5]. But with more number of public sectors, platforms, amusement locations it requires installation of more display units. And that drains a lot of power. One way to overcome this problem is to devise LEDs that run on less power. Another obvious way was to implement the same display using lesser LCDs. Bob Blick created the first propeller clock [2] [8], which spins a single column of LEDs along a horizontal circle to produce the display. The same method has been adopted here as it is most suitable for visibility from all sides. Here, we have used a chip, PCF8583 [3] which is known as the 'Real Time Clock (RTC)', whose property is to provide the current time when accessed. The difference of our unit from the 'propeller clock' is the use of this chip which is absent in the 'Propeller Clock', thus allowing us to highlight a different method of displaying using the concept of 'Persistence of Vision'. Our unit contains only 16 LEDs which are used to display a working clock. The advantage of such a displaying scheme is that the power consumed for displaying lengthy texts remains the same as that consumed in case of smaller texts. But here, we have shown a working clock through our unit although it can be extended to use as a general display unit.

II. PERSISTENCE OF VISION:

Whenever an object is placed in front of the human eye and then removed, the impression of the object remains for about 1/25th of a second even after the object is removed. If a series of pictures is held and then removed from before the eye in quick succession, the eye perceives this situation as a series of moving pictures. It happens mainly due to the inability of the human brain to process and distinguish between the pictures so quickly. Using this principle, an entire line of text is displayed using 8 LEDs.

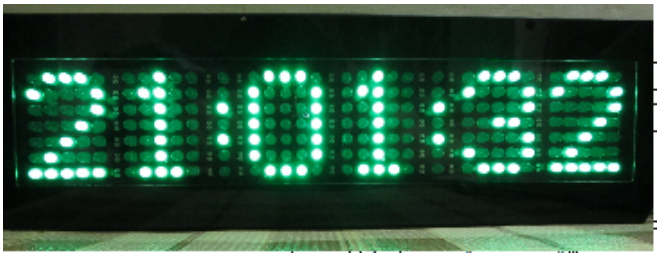


Fig 1: Existing display units: LED mesh

PCF8583:

It is known as a real time clock (RTC) that keeps track of the current time. Although RTCs are commonly used in computers and mobiles, but it is also used in those gadgets which require accurate timekeeping. It has an alternate source of power which enables the RTC to update the time when main power is unavailable. Most RTCs use a crystal oscillator with a frequency of 32.768 kHz which is exactly 2^{15} cycles per second which is a convenient rate to use with simple binary counter circuits.

IV. METHODOLOGY:

Each port of the 89C52 [7] microcontroller is fitted with a resistor array of 1k. The 2 sets of 8 LEDs are connected to the ports 0 and 2, while port 3 is used to connect the microcontroller to the RTC: PCF8583. The phototransistor which is the receiver in this case is connected to a pin in port 3 while port 1 remains unused. There is no physical connection between the transmitter and the receiver, but they complement each other during the circuit operation.

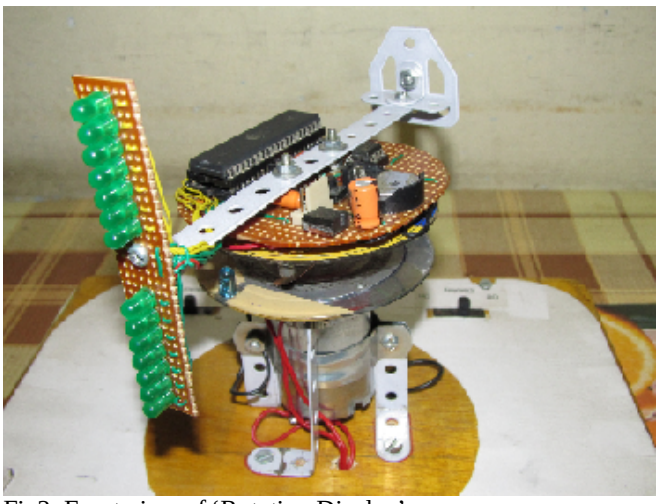


Fig2: Front view of 'Rotating Display'

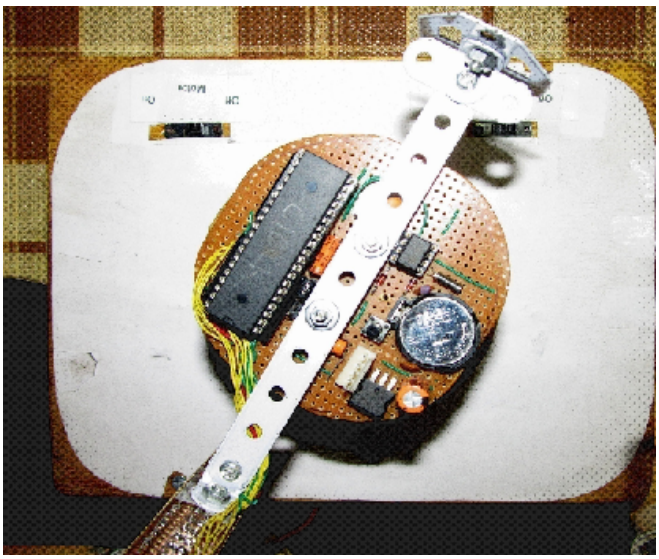


Fig 3: Top view of 'Rotating Display'

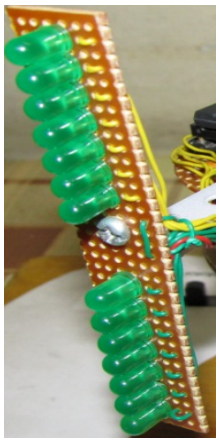
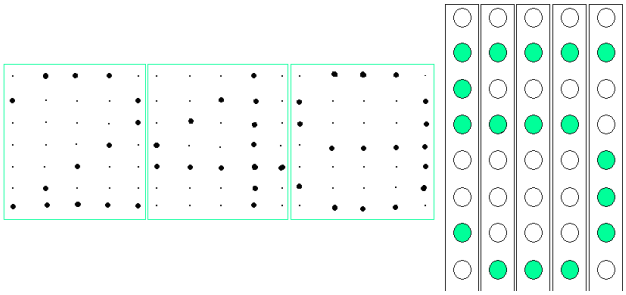


Fig 4: The display unit of 'Rotating Display'

V. PRINCIPLE OF OPERATION

The 89C52 microcontroller inputs the current time into it from the RTC (pcf8583) and selectively turns ON and OFF the LEDs to display the text. When the motor rotates, the 16 LEDs glow in a certain sequence which is determined by the program inside the 89C52 microcontroller and the full text is displayed when it receives the interrupt from the infrared LED fitted below the rotating part. Whenever the phototransistor receives the beam from the IR LED, it sends the series of data sequences to glow all the LEDs, one column at a time. But the human eye, due to 'Persistence Of Vision' cannot determine such a fast change and so the entire display is visible.

VI. DISPLAYING A CHARACTER:



Here in a particular character, say '2', each column represents the combination of 8 LEDs. The topmost LED is always kept OFF so as to ensure that there are 7 rows. To display the first column of '2', the pattern or sequence of binary bits to be sent is 00100001, i.e. 21 in hexadecimal. Similarly for the next column, the desired pattern is 01000101, i.e. 45 in hexadecimal. When the rest of the rows for '2' are calculated and this series of data patterns are sent to the microcontroller,

as soon as 89C52 gets the interrupt, it sends this information, column by column. But due to the slow perception of the human eye, we get the impression of all the five columns together giving us the impression that the digit '2' is displayed when the entire device rotates. If '24' is to be displayed, the microcontroller first sends the required data pattern to display the last column of '4', then the second last column's data pattern is sent until the data pattern of the first column of '2' is sent. Here also, the interrupt informs the microcontroller the time when the text is to be displayed.

VII. BASIC BLOCK DIAGRAM

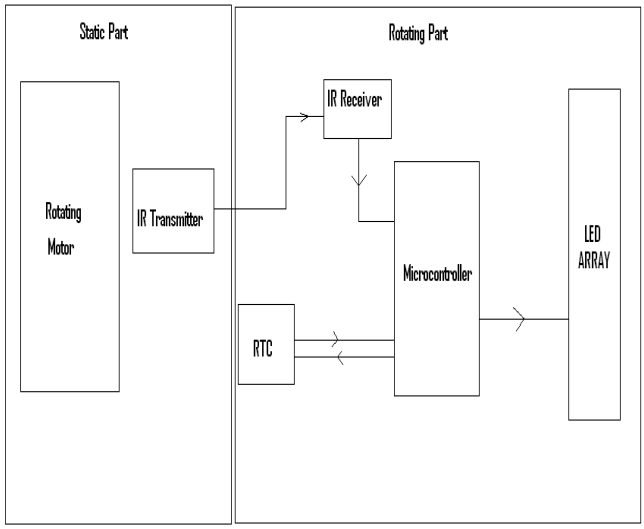


Fig 5: Basic block diagram of 'Rotating Display'

The unit consists of broadly two parts: **Static** and **Rotating** part.

The static part consists of:
Motor having 200rpm which is responsible for the continuous rotation of the entire unit.
IR Transmitter which provides an Infra red beam and is received by the receiver of the Rotating part. This IR beam acts as the source of interrupt for the 89C52 microcontroller

The Rotating part consists of:
IR Receiver which receives the IR beam transmitted by the IR transmitter of the static part. When the beam falls on the receiver, the interrupt bit of the microcontroller is set.
Microcontroller used here is the ATMEL 89C52.
RTC is the main component in the entire unit. It updates the time that is to be displayed.
LED Array of 16 LEDs is used to display the time.

VIII. ALGORITHM

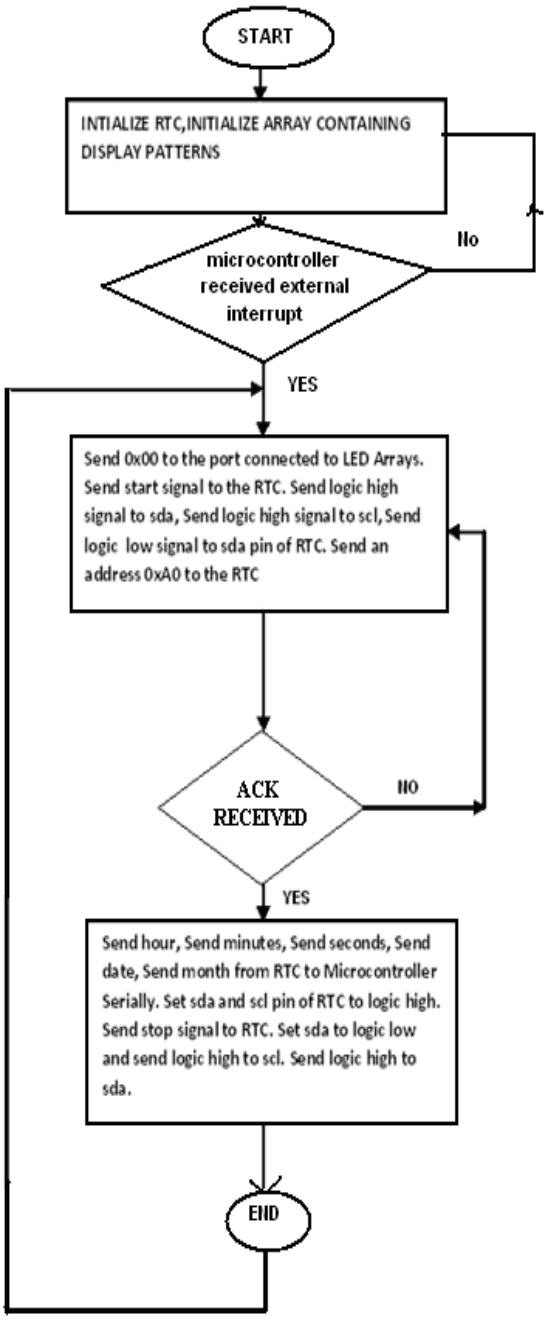


Fig 6: Flowchart demonstrating the algorithm

IX. CIRCUIT CONNECTION:

The circuit connection is shown in Figure 7.

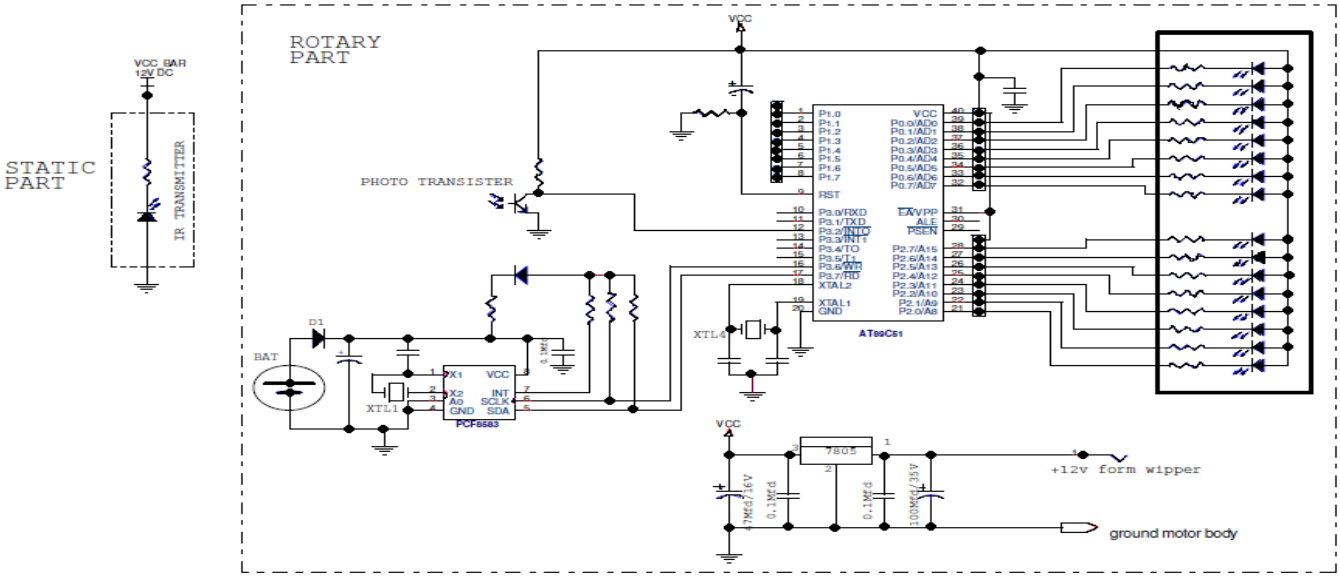


Fig 7: The entire circuit connection

X. OBSERVATIONS:

Fig 8: Display after running the unit

XI. CONTRIBUTION:

Some of the advantages of Rotating Display over existing LED displays are as follows:

1. The rotating display uses only 16 LEDs to display any message. This eliminates the necessity to use many LEDs and thus removes the complexity of the circuit involved.
2. The Rotating Display is portable, light unlike some existing displays which are large and heavy.
3. Owing to a fixed number of LEDs, power consumed remains the same whatever may be the length of the text to be displayed.

XII. DISCUSSION:

The Rotating Display is very useful in places like railway stations where the display boards are visible from only one side. It can make any display visible from all sides (360^{o}).

XIII. CONCLUSION:

The Rotating Display thus performs the dual function of an energy saver as well as removing the problem of visibility from all sides as it takes care of both the problems. The display size can also be modified using motors of different speeds which makes it even more useful.

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