SMART MIRROR USING 8052 MICROCONTROLLERS

Mayuri Shinde, Vidula Joshi and Ashish Koli

Department of Physics, B.N. Bandodkar College, Thane.

University of Mumbai.

mayurishinde.103@gmail.Com

ABSTRACT

The basic purpose of a Mirror is 'to reflect'; it gives an image of whatever lies in front of it. The implementations of Science and Technology in our day-to-day activities make life more productive, efficient and raise our standard of living. We here have made an attempt to implement technology in a simple, plain yet widely used object, a Mirror. In our Smart Mirror Project, we have tried to upgrade the functions of a Mirror by displaying User defined information and Real Time and Date only when the mirror detects a presence in front of it. Thus, the Smart Mirror is an informative mirror which displays the data when it is triggered. The Smart Mirror shows Real Time and Date, this was achieved by interfacing AT89S52 Microcontroller with Real Time Clock (RTC Module with DS1307) and a 16 x 2 LCD. Communication between the Microcontroller and RTC was done using I2C Protocol. Polarized glass in place of regular glass was used in order to display information on the mirror. An IR Sensor is placed at the top side of the mirror which triggers the Mirror ON.

Keywords: Smart mirror, AT89s52 microcontroller, LCD (16*2), LM358, IR sensor (Photo diode & receiver), Crystal (11.0592 MHz)

INTRODUCTION

The Smart Mirror is a novel concept that aims to bring efficiency and productivity to the users. This Project is built using the low power, high-performance 8-bit Microcontroller the AT89S52 by Atmel. As an 8-bit Microcontroller is used the product is cost efficient and is available at a feasible rate. The Project consists of two parts first is the IR sensor detection and the second is reading the information from RTC and displaying it on the mirror.

IR SENSOR (Elprocus, n.d.)

An IR sensor is used to detect the presence of a person and even can detect motion. Every object emits radiation when observed in the infrared spectrum. The IR sensors detect this radiation and they work only in the infrared range. An IR sensor consists of two parts, the transmitter circuit and the receiver circuit. This is collectively known as a photo-coupler or an opto-coupler. The transmitter is an IR LED and the receiver is an IR photodiode. The IR photodiode is sensitive to

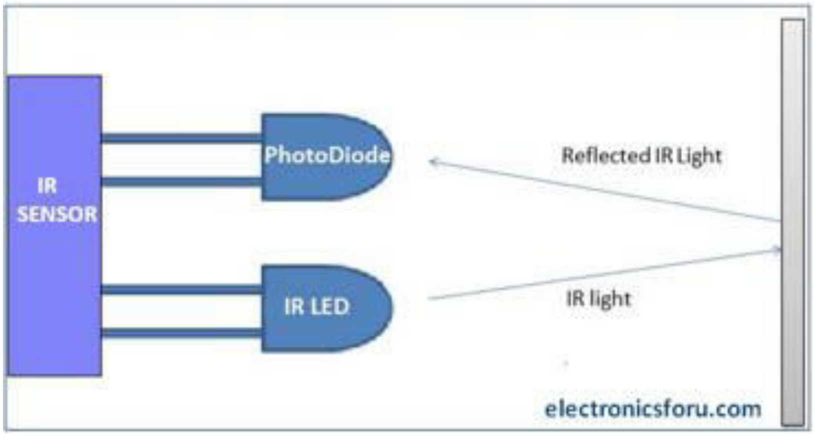

Fig.1 Working of IR Sensor

the IR light emitted by an IR LED. The photo-diode's resistance and output voltage change in proportion to the IR light received. This is the underlying working principle of the IR sensor. This circuit comprises of the following components

- LM358IC
- IR transmitter and receiver pair
- Resistors of the range of 10 kilo-ohms to 100 ohms.
- Variable resistors.
- LED (Light Emitting Diode)

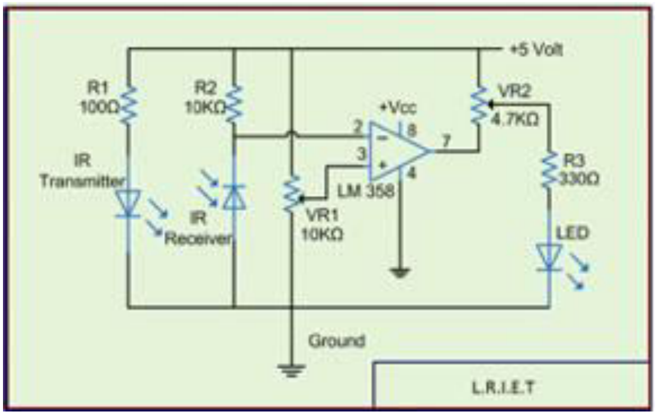

Fig.2 Circuitry for IR Sensor using IC LM 358

When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM358). Thus, the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives signal to the potential at the inverting input goes low. Thus, the output of the comparator (LM 358) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10 mA current passes through the IR LED Devices like

Photodiode and normal LEDs respectively. Resistor VR2 (pre-set=5k) is used to adjust the output terminals. Resistor VR1 (pre-set=10k) is used to set the sensitivity of the circuit. The type of incidence can be direct incidence or indirect incidence. In direct incidence, the IR LED is placed in front of a photodiode with no obstacle in between. In indirect incidence, both the diodes are placed side by side with an opaque object in front of the sensor. The light from the IR LED hits the opaque surface and reflects on the photodiode. We have used the indirect incidence. IR sensors find a wide variety of applications in various fields. Proximity Sensors, Line Follower Robots, Item Counter, Burglar Alarmed, etc.

RTC (Real Time Clock) (datasheet of RTC DS 1307)

The purpose of an RTC or a real time clock is to provide precise time and date which can be used for various applications. RTC is an electronic device in the form of an Integrated Chip (IC) available in various packaging options. It is powered by an internal lithium (CMOS) battery. As a result of which even if the power of the system is turned off, the RTC clock keeps running. An RTC maintains its clock by counting the cycles of an oscillator – usually an external 32.768kHz crystal oscillator circuit, an internal capacitor-based oscillator, or even an embedded quartz crystal

FEATURES OF RTC DS1307:

- This chip is capable of operating in either 24 hour or 12-hour format and can be changed by the user.
- The end of the month is automatically adjusted with fewer 31 months including the leap year corrections.
- It is capable of sensing power cut off from external supply and automatically switches to alternative battery supply connected to it.
- Less power consumption and small size makes it to use in all level of applications
- It plays a very important role in the real time systems like digital clock, attendance system, digital camera etc.

X1 and X2**:** These pins are used to connect an external crystal oscillator to provide the clock source for the chip. According to the datasheet, a quartz crystal of 32.768 kHz should be used along with this chip.

VBAT: This pin is used to connect a +3V lithium battery to provide supply when the external supply voltage is not available. This pin should be grounded when not in use.

SQW/OUT: This output pin provides pulse ranging from frequency 1 kHz, 4kHz, 8 kHz or 32 kHz and needs a pull up resistor to operate.

SCL and SDA: These two pins are used for carrying data in the I2C bus and must be connected to the SCL and SDA pins of the Microcontroller.

VCC and GND: These pins are supply and ground pins for the chip.

I2C COMMUNICATION PROTOCOL (Mazidi, *et al*., 2009; Data sheet of RTCDS1307)

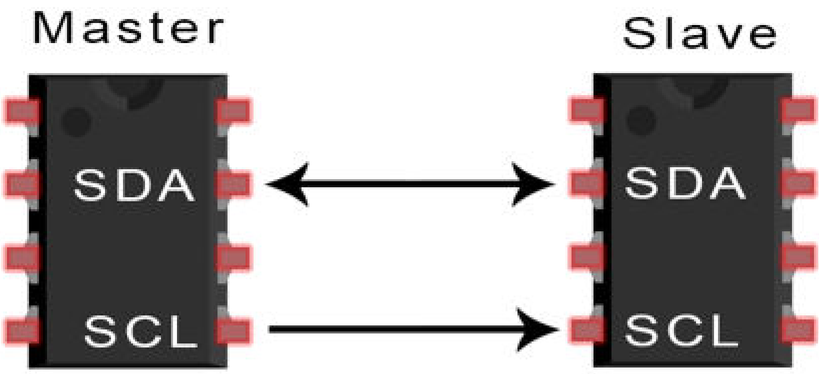

Fig.3 Master – Slave Communication

I2C helps you to connect multiple slaves to a master and you can have multiple masters controlling single, or multiple slaves. I2C only uses two wires to transmit data between devices:

SDA 2(Serial Data) – The line for the master and slave to send and receive data.

SCL (Serial Clock) – The line that carries the clock signal.

I2C is a serial communication protocol, so data is transferred bit by bit along a single wire (the SDA line).

I2C WORKING (Mazidi, *et al*., 2009; Datasheet of RTCDS1307)**:** With I2C, data is transferred in messages. Messages are broken up into frames of data. Each message has an address frame that contains the binary address of the slave, and one or more data frames that contain the data being transmitted. The message also includes start and stop conditions, read/write bits, and ACK/NACK bits between each data frame:

Start Condition: The SDA line switches from a high voltage level to a low voltage level before the SCL line switches from high to low.

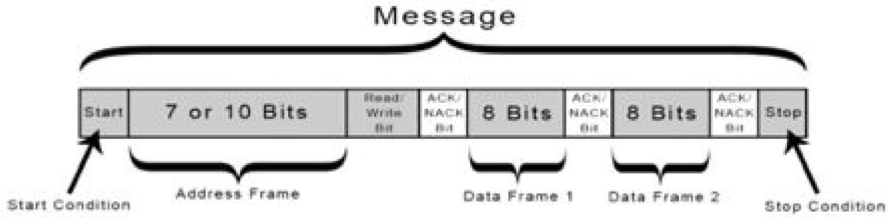

Fig.4 Data Framing for I2C communication with RTC

Stop Condition: The SDA line switches from a low voltage level to a high voltage level after the SCL line switches from low to high.

Address Frame: A 7 or 10-bit sequence unique to each slave that identifies the slave when the master wants to talk to it.

Read/Write Bit: A single bit specifying whether the master is sending data to the slave (low voltage level) or requesting data from it (high voltage level).

ACK/NACK Bit: Each frame in a message is followed by an acknowledge/no-acknowledge bit. If an address frame or data frame was successfully received, an ACK bit is returned to the sender from the receiving device.

ADDRESSING: *I2C doesn't have slave select, so it needs another way to let the slave know that data is being sent to it, and not another slave. It does this by addressing. The address frame is always the first frame after the start bit in a new message.*

The master sends the address of the slave it wants to communicate with to every slave connected to it. Each slave then compares the address sent from the master to its own address. If the address matches, it sends a low voltage ACK bit back to the master. If the address doesn't match, the slave does nothing, and the SDA line remains high.

READ/WRITE BIT: *The address frame includes a single bit at the end that informs the slave whether the master wants to write data to it or receive data from it. If the master wants to send data to the slave, the read/write bit is a low voltage level. If the master is requesting data from the slave, the bit is a high voltage level.*

THE DATA FRAME: *After the master detects the ACK bit from the slave, the first data frame is ready to be sent. The data frame is always 8 bits long and sent with the most significant bit first. Each data frame is immediately followed by an ACK/NACK bit to verify that the frame has been received successfully. The ACK bit must be received by either the* *master or the slave (depending on who is sending the data) before the next data frame can be sent. After all the data frames have been sent, the master can send a stop condition to the slave to halt the transmission. The stop condition is a voltage transition from low to high on the SDA line after a low to high transition on the SCL line, with the SCL line remaining high e address doesn't match, the slave does nothing, and the SDA line remains high.*

POLARIZED GLASS: We used the glass usually used for the windows. These glasses are reflecting from one side and semi partial from the other side. We use this idea for showing the display information behind the mirror. The polarized glass allows us to give an effect that the words and information are displayed on the mirror, although the LCD is being attached behind glass and polarized glass. The LCD is placed behind that side of the polarized glass which is semi partially transparent. When the LCD's black light is ON, the light travels through the polarized glass, allowing it to appear on the mirror.

WORKING (Deshmukh, 2007; Mazidi, *et al.*, 2009; Data sheet of AT89S52)**:** The first part is to determine and detect if anyone is standing in front of the mirror or not. And the second part is that once the person is detected the LCD should be triggered to display the information. The RTC here is used to maintain the current time and date. The data of the RTC is continuously sent to the LCD. The two parts of out project are: -

- Detection of the person
- Display of the information

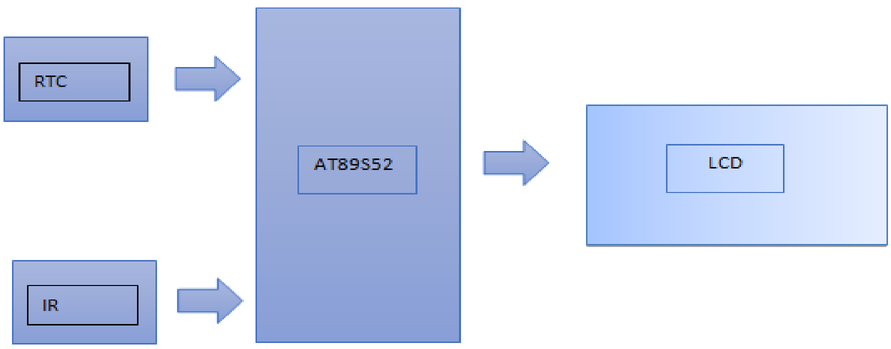

Fig. 5 Block Diagram

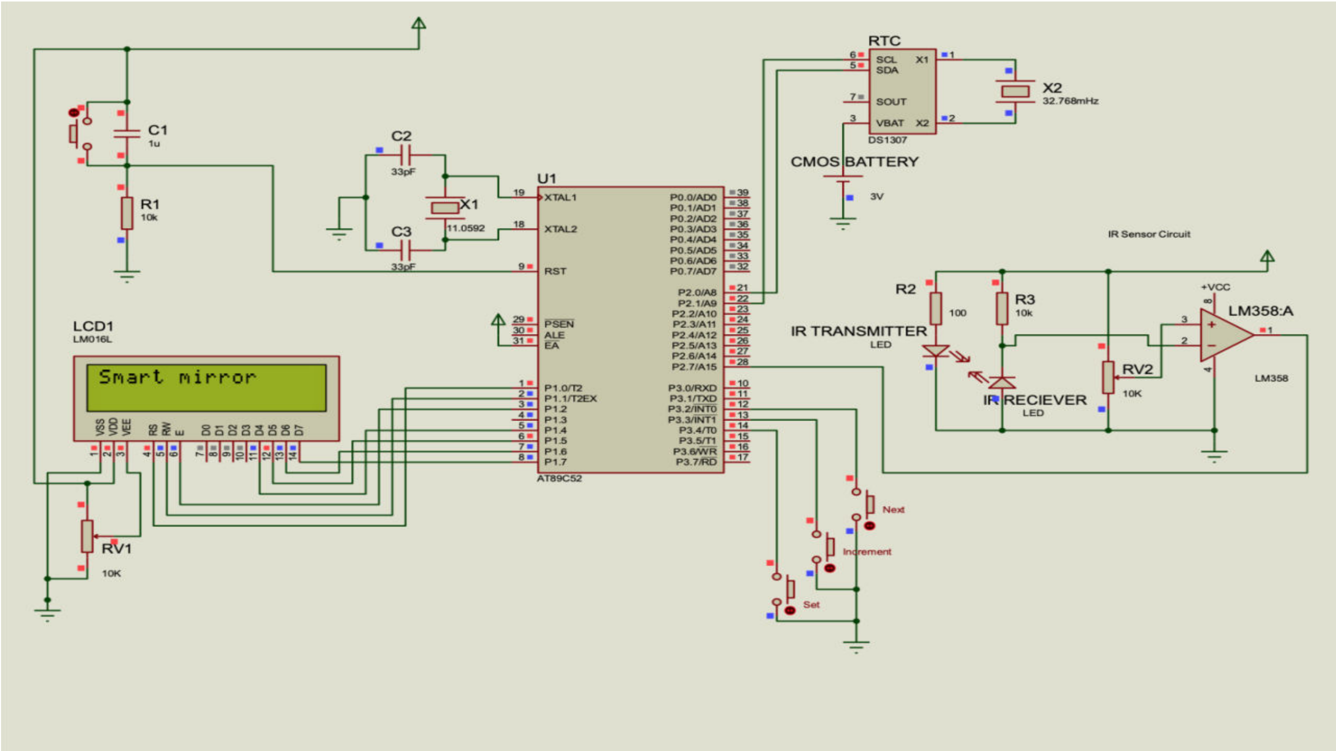

Fig. 6 Circuit Diagram

Detection of the person

For the first part that is the detection of the person, we have used an IR sensor. A simple code of IF then Else is used for this. When IR sends a high output, when it detects a person in front of it. The output is then sent to the microcontroller.

Display of the information: - For the second part the output of IR Pin, which is given as input to the microcontroller, determines whether the corresponding pin which is given to the LCD's blacklight should be high or low, i.e. where the LCD's pin number 15 is connected. If the IR sensor gives the output high the blacklight pin goes high, which allows us to see the display, on LCD.

RTC working: - The RTC here is programmed to give the date and time. The RTC keeps on giving continuous date and time as output. As the RTC has a CMOS battery hence we must set the RTC only once at the beginning. The data from RTC is displayed on the LCD.

CONCLUSION

Smart mirror was successfully built using Microcontroller 89AT52 using I2C communication protocol between RTC and Microcontroller.

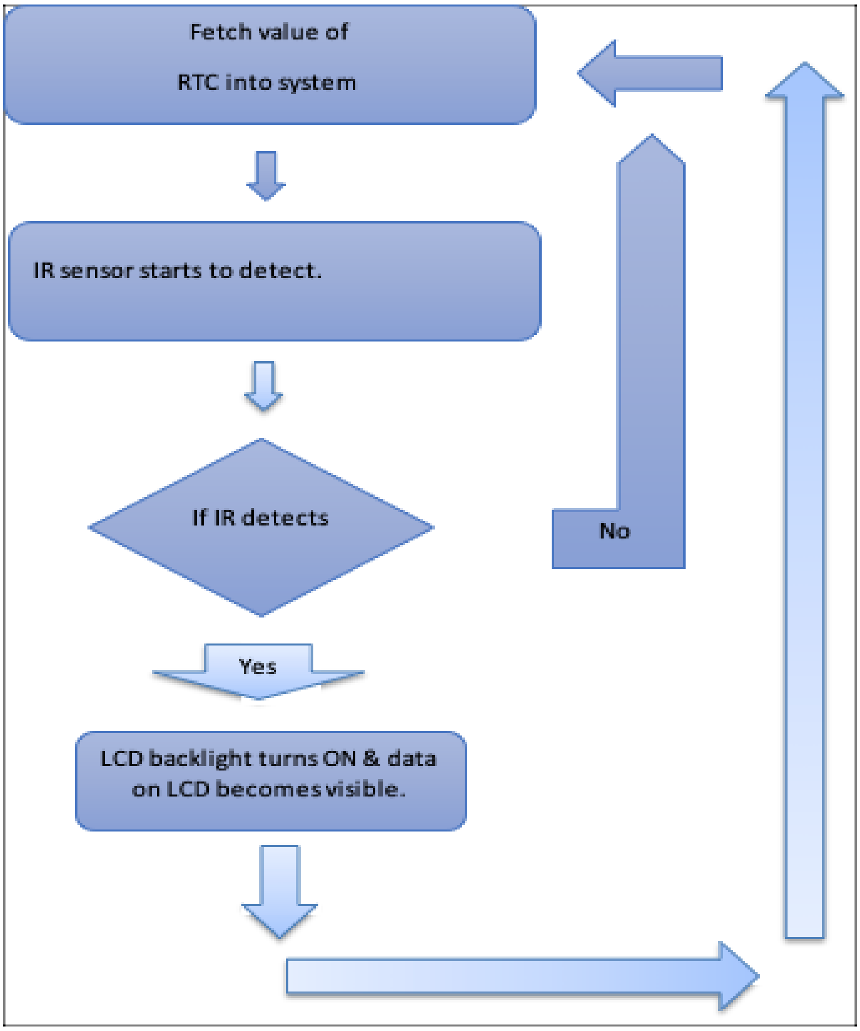

Fig. 7 Flow Chart

REFERENCES

1. Deshmukh. A. V. (2007). Microcontrollers: Theory and Applications. Published by Tata McGraw-Hill Company Ltd., New Delhi.
2. Mazidi, M. A., Mazidi, J. G. and McKinlay, R. (2009). The 8051 Microcontroller and Embedded Systems: Using Assembly and C. 2nd edition, Published by Dorling Kindersley (India) Pvt. Ltd. South Asia.
3. AT89S52: - Data sheet of AT89S52
4. Elprocus, (n.d.) Infrared IR Sensor Circuit Diagram and Working Principle https://www.elprocus.com/infrared-ir-sensor-circuit-and-working/
5. RTC: - Data Sheet of RTC (DS 1307)