DIGITAL CALCULATOR

USING

ARDUINO UNO R3

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INTRODUCTION

A basic calculator performing four mathematical functions namely addition, subtraction, multiplication, division using ARDUINO UNO R3. Input is given via TSOP IR Remote Sensor which captures the key press and corresponding output is shown on 7 Segment Display.

Remote keys layout:

* 0 to 9: respective digits.
* Volume + key: addition.
* Volume – key: subtraction.
* Next key: multiplication.
* Previous key: division.

TSOP IR Sensor pins:

* Pin1 : +5V
* Pin2 : GND
* Pin3 : digital pin 11

7 Segment Display (cathode) emulates the appearance and functionality of a calculator using the graphical user interface to portray a calculator. Output is displayed in 2 digit format in continuation with a delay gap of 1 second.

LED is used as an indicator to the key press detection. LED pins:

* Anode: digital pin 13.
* Cathode: GND.

PROBLEM STATEMENT

As calculator is a valuable educational tool that allows students to reach a higher level of mathematical power and understanding. Calculator covers a tremendous range of capabilities and serve as an equalizer in mathematics education . Thus our project consists of

* a single digit calculator that is capable of performing basic arithmetic operations .
* yields result of atmost two digits.
* a device is used to sense the input numbers and the operation to be performed on those numbers
* a device to display the calculated answer.
* the interfacing device is a microcontroller/microprocessor.

REQUIREMENT

HARDWARE

* INDUINO R3: ARDUINO Rev3 clone with ATmega328 microcontroller loaded with ARDUINO UNO Bootloader. It has 14 digital input/output pins, 6 analog inputs, 16 MHz crystal oscillator, a USB connection, an In Circuit Serial Programming Header( ICSP) and reset button. The following is the list of On-Board Peripherals:
* 3 LEDS on digital pins 11,12 & 13 [for experimentation with digital outputs]
* 3 Push Buttons on digital pins 7,8 & 9 [for experimentation with digital inputs]
* 1 RGB Led [experimentation with analog outputs / PWM].
* TSOP IR Remote Control: A sensor HX1838, high sensitivity   
  Operating voltage 5 V , Digital output. Module Interface Description :
  + - * 1-VCC external 3.3V-5V .
      * 2-External Ground.
      * 3-IN external microcontroller i/o port.
* Bread Board, 7 Segment Display(cathode), LED (yellow), jump wires.

SOFTWARE

ARDUINO is a single-board microcontroller. Its software consists of a standard programming language compiler and a boot loader that executes on the microcontroller. ARDUINO IDE version 1.0.5 with library import functionality to install IR Remote library to receive and transmit IR Remote Control codes.

SOLUTION

FLOWCHART

INPUT OPERATOR1, OPERAND, OPERATOR2

Decode the key by its hash value & display on 7 segment.

If ‘+’

NO

NO

NO

If ‘/’

If ‘ \*’

If ‘-‘

YES

YES

YES

YES

Ans=op1+op2

Ans= op1 /op2

Ans=op1\*op2

Ans=op1 - op2

Output answer on 7 segment display

BLOCK DIAGRAM

15 GND VCC



012..GND..SCL

**TSOP (RECEIVER)**

IR SIGNAL

**REMOTE (TRANSMITTER)**

2,3,4,5,6,7,8,9,GND

**7 SEGMENT DISPLAY (CATHODE)**

**ARDUINO BOARD (ATmega328)**

METHOD

Sensing of digits are done through IR Remote Control Module with sensor HX1838 which can receive 38k remote frequency encoded data. IR Remote Library decodes the digits received from infra-red remote and generates corresponding 24 bit hash value. The unique hash value for each key will help to determine the input and displays the corresponding answer on 7 segment display in two-digit format.

CODE

#include <IRremote.h>

int recvLED = 13;

int recvPin = 15;

IRrecv irReciver(recvPin);

decode\_results results;

byte s7segment[] = { 2, 3, 4, 5, 6, 7, 8, 9 };

void setup()

{

pinMode(recvLED, OUTPUT);

digitalWrite(recvLED, LOW);

Serial.begin(9600);

irReciver.enableIRIn();

for (int i=0; i<8; i++)

{

pinMode(s7segment[i], OUTPUT);

}

}

byte digits[][13] = {

{ 1, 1, 1, 1, 1, 1, 0, 0},

{ 0, 0, 1, 1, 0, 0, 0, 0},

{ 1, 1, 0, 1, 1, 0, 1, 0},

{ 0, 1, 1, 1, 1, 0, 1, 0},

{ 0, 0, 1, 1, 0, 1, 1, 0},

{ 0, 1, 1, 0, 1, 1, 1, 0},

{ 1, 1, 1, 0, 1, 1, 1, 0},

{ 0, 0, 1, 1, 1, 0, 0, 0},

{ 1, 1, 1, 1, 1, 1, 1, 0},

{ 0, 1, 1, 1, 1, 1, 1, 0},

{ 1, 0, 1, 1, 1, 1, 0, 0},

{ 1, 1, 1, 1, 0, 1, 0, 0},

{ 1, 0, 1, 1, 0, 1, 1, 0},

{ 1, 1, 1, 1, 1, 1, 0, 0}

};

const unsigned long decodeHASH[] = {

0xFF6897,

0xFF30CF,

0xFF18E7,

0xFF7A85,

0xFF10EF,

0xFF38C7,

0xFF5AA5,

0xFF42BD,

0xFF4AB5,

0xFF52AD,

0xFFA857,

0xFFE01F,

0xFF02FD,

0xFF22DD

};

unsigned long lastTime = 0;

int input()

{

unsigned long recv\_value;

int p,b;

while (!irReciver.decode(&results)) {

}

if (irReciver.decode(&results)) {

recv\_value = results.value;

Serial.println("hex value:");

Serial.println(recv\_value, HEX);

if ( recv\_value == 0xFF6897 || recv\_value == 0xFF30CF || recv\_value == 0xFF18E7 || recv\_value == 0xFF7A85 || recv\_value == 0xFF10EF || recv\_value == 0xFF38C7 || recv\_value == 0xFF5AA5

|| recv\_value == 0xFF42BD ||recv\_value == 0xFF4AB5 || recv\_value == 0xFF52AD || recv\_value == 0xFFA857 || recv\_value == 0xFFE01F ||recv\_value == 0xFF02FD || recv\_value == 0xFF22DD ) //Ignore the 0x00 values recived as a result of pressing and holding a button on the remote for long

{

digitalWrite(recvLED, HIGH);

delay(10);

digitalWrite(recvLED, LOW);

Serial.println(recv\_value, HEX);

for (int i=0; i<=13; i++)

{

if ( recv\_value == decodeHASH[i] )

{

lastTime = millis();

p = i;

for (int j=0; j<=8; j++)

digitalWrite(s7segment[j], digits[i][j]);

break;

}

}

} else {

p = 122;

}

irReciver.resume();

}

Serial.println("input : ");

Serial.println(p);

return p;

}

void loop()

{

int i;

int p,rp,sum,r,a=122,b=122,c=122;

while (!irReciver.decode(&results)) {

}

while (1) {

a = input();

if (a != 122)break;

}

Serial.println("loop1 :");

Serial.println(a);

i = a;

delay(1000);

while (!irReciver.decode(&results)) {

}

while (1) {

b = input();

if (b != 122)break;

}

Serial.println("loop2 :");

Serial.println(b);

i = b;

delay(1000);

while (!irReciver.decode(&results)) {

}

while (1) {

c = input();

if (c != 122)break;

}

Serial.println("loop3 :");

Serial.println(c);

i = c;

delay(1000);

if (b == 10) {

sum = a+c;

} else if (b == 11) {

sum = a-c;

} else if (b == 12) {

sum = a\*c;

} else if (b == 13) {

sum = a/c;

}

p = sum;

sum = sum/10;

rp = sum\*10;

r = p - rp;

for (int ij = 0; ij <= 9; ij++) {

if (sum == ij) {

i = sum;

for (int j = 0; j <= 8; j++) {

digitalWrite(s7segment[j], digits[i][j]);

}

}

}

delay(1000);

for (int ij = 0; ij <= 9; ij++) {

if (sum == ij) {

i = r;

for (int j = 0; j <= 8; j++) {

digitalWrite(s7segment[j], digits[i][j]);

}

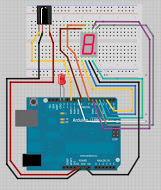
}

}

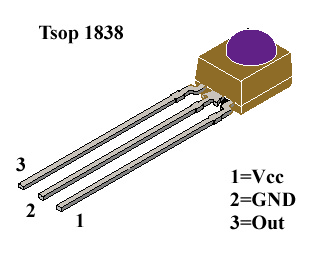
delay(1000);

}

CIRCUIT DIAGRAM/IMAGE



PICTORIAL REPRESENTATION



TSOP IR REMOTE SENSOR

RESULT & DISCUSSION

RESULT

0-9, +, -, \*, / are sensed from the remote feed and the operation is performed. Output from the module echoes the answer on 7 segment display to represent each number. Calculator produces result in two digit format only.

DISCUSSION

Learnt about interfacing hardware and software using ARDUINO . The microcontroller board is used to develop the interactive calculator taking input from sensors and controlling variety of operations and other physical outputs. Familiarization with IR Remote Control technology, use of light to carry signals between a remote control and device its directing. The transmitter sends out pulses of IR light that represents specific binary codes, these binary codes correspond to commands( 0-9,+,-,\*,/) . The IR receiver decodes the pulse of light and then the microcontroller carry out the corresponding command. The 7 Segment display require only 9 pins as the cathode of the segment LEDs are connected to a common pin refered to as common cathode. Fundamentals of the microcontroller is understood which facilitates programming and incorporation into other circuits.

REFERENCES

* [www.arduino.cc](http://www.arduino.cc)
* [www.simplelabs.co.in](http://www.simplelabs.co.in) & [www.graylogix.com](http://www.graylogix.com)
* [www.youtube.com/watch?v=caMW1RRPOGE](http://www.youtube.com/watch?v=caMW1RRPOGE)