CBSE REGIONAL SCIENCE FAIR 2011

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Class: XI B

Project: iHouse

School: Essar International School.

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Brief Description

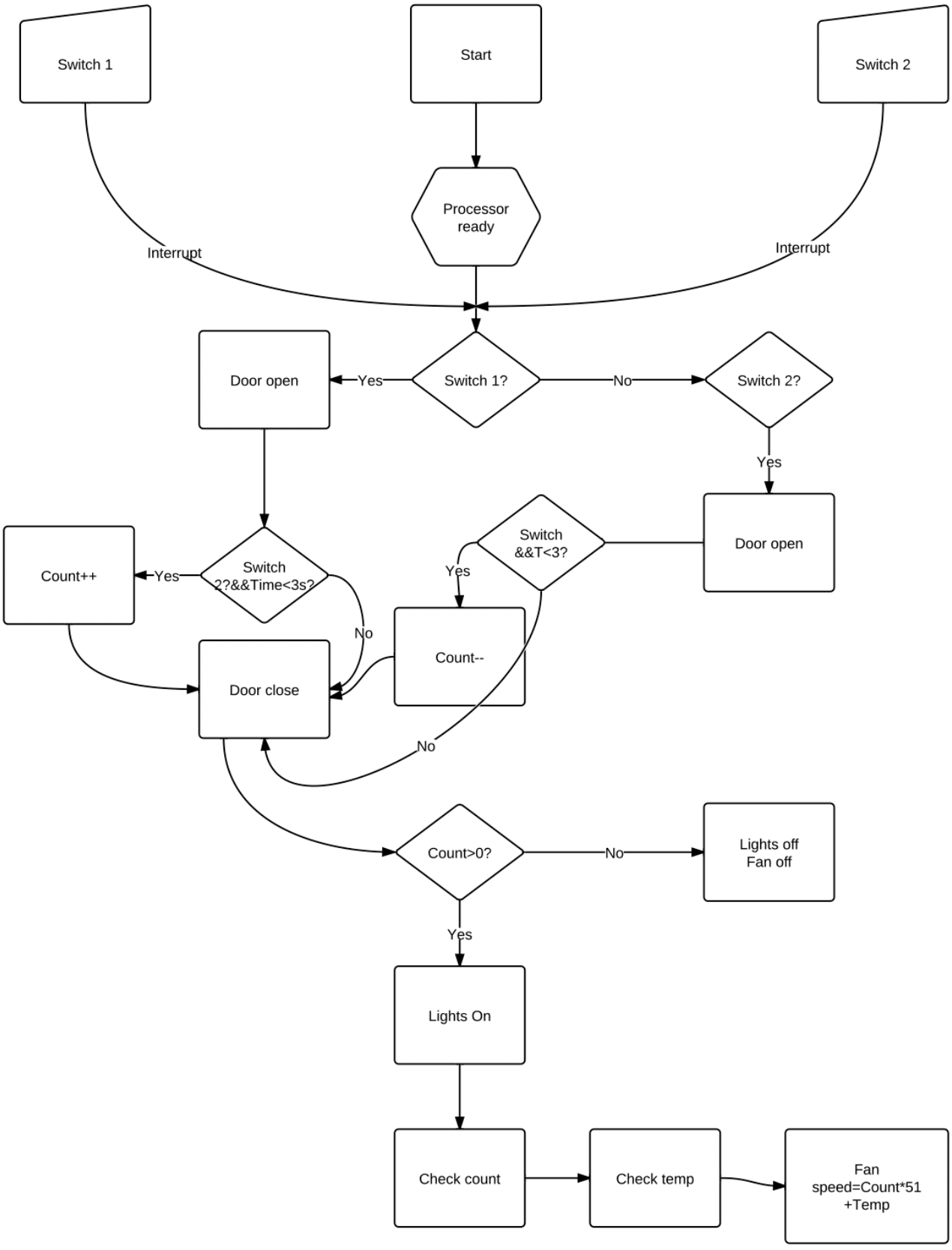
The house consists of three rooms. Each room has its own Freeduino and a small led 7 segment display which shows the number of people in the room. The windmills are placed on top of the room. Each room also has a temperature system, led lights and a motor for ventilation. The doors are controlled by motors attached to their hinges.

The microcontroller in each room controls all the appliances in that room. It adjusts all the variables by counting the number of people in the room. It also shuts down everything if it detects no people in the room.

The system can be easily installed and scaled up to a real house using relays and better components. When installed, it will be hardly noticeable.

It’s made up of cheap parts but the system can go a long way in saving electricity, especially in a country like India where the power infrastructure is inadequet.

FLOW CHART


Switch 1
Start
Switch 2
Processor ready
Interrupt
Interrupt
Door open
Yes
Switch 1?
No
Switch 2?
Yes
Count++
Yes
Switch 2?&&Time<3s?
Switch &&T<3?
Yes
Door open
No
Count--
Door close
No
Count>0?
No
Lights off
Fan off
Yes
Lights On
Check count
Check temp
Fan speed=Count*51 +Temp

SOURCE CODE

```
/* Source code of iHouse.
Author:Karan Shah
Dt:12th August, 2011 */

#include "Seg7.h" //Used to control seven segment display
Seg7 s7;
int temps=A0;
float temp;
int s1=2;
int s2=3;
int dro=0;
int rel=12;
int fan=11;
int base=0;
int led=13;
int i;
int a=0;
int b=0;
volatile int count=-1;
volatile long t1=0;
volatile long t2=0;
volatile long t3=0;
```

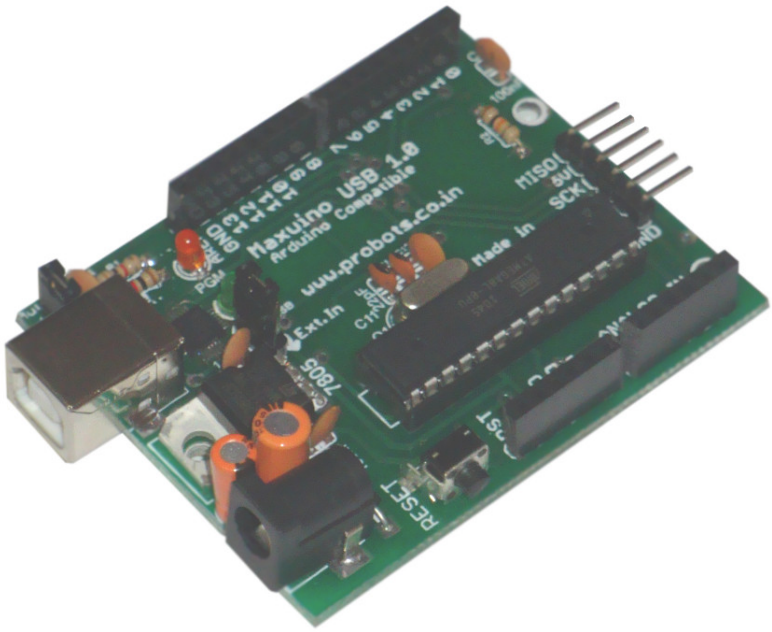
```
void setup()
{  s7.attach( 4,5,6,7,8,9,10,99);
  pinMode(s1,INPUT);
  pinMode(s2,INPUT);
  for(i=4;i<=13;i++)
  { pinMode(i,OUTPUT);}
  pinMode(led,OUTPUT);

  digitalWrite(led,LOW);
  analogWrite(fan,0);

attachInterrupt(0,doorop,RISING);
  attachInterrupt(1,doorcl,RISING);
}

void doorop()
{
  t1=millis();
  digitalWrite(dro,HIGH);
  delay(30);
  digitalWrite(dro,LOW); a=1;
}
void doorcl()
{
  t2=millis();
  digitalWrite(rel,HIGH);
  delay(39);
  digitalWrite(rel,LOW); b=1;   }
```

```
void loop()
{ if(a==1&&t1-millis()>3000)
  {digitalWrite(rel,HIGH);
  delay(39);
  digitalWrite(rel,LOW); a=0;}

  if(b==1&&t2-millis()>3000)
  {digitalWrite(rel,HIGH);
  delay(39);
  digitalWrite(rel,LOW); b=0;}

if(t1==t2)
{count=count; t3=0;}

if(t1<t2)
{ t3=t2-t1;
  if(t3<3000)
  { count++;

  t1=t2=0;} }
else if(t1>t2)
  {t3=t1-t2;
   if(t3<3000)
  { count--;
   t1=t2=0; }
}
```

```
if(count>0)
  {temp=(5.0*analogRead(temps)*100)/1024;
  base=count*51;
  if(base<=255)
  { if(temp<25) { analogWrite(fan,base); }
    if(temp>=25) { analogWrite(fan,base+(temp*1.5));}}
 else {analogWrite(fan,255); }

   s7.write(count);
   digitalWrite(led,HIGH); }

   else if(count<=0)
  {analogWrite(fan,0);
   s7.write(0);
   count=0;
   digitalWrite(led,LOW); }

}
```

Hardware

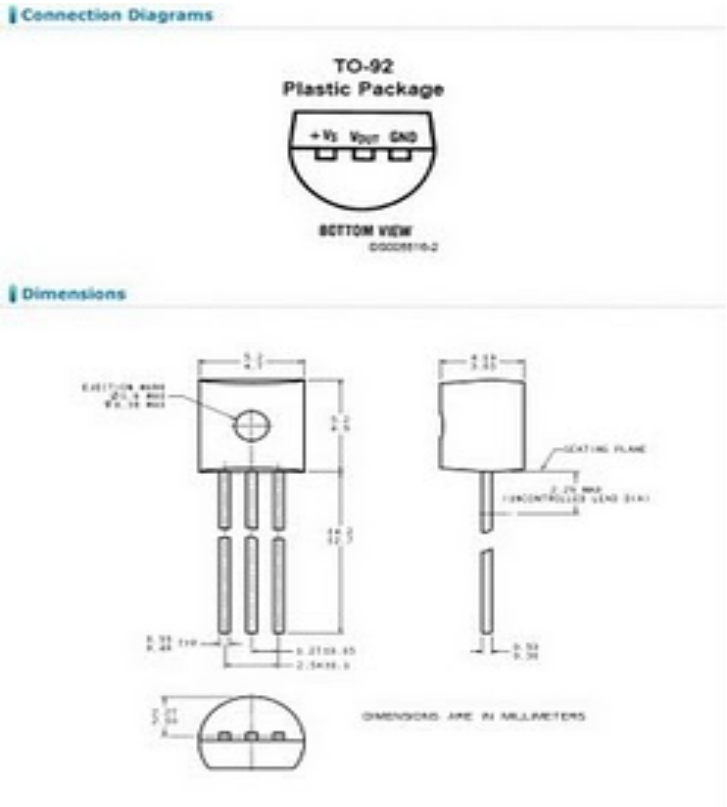
Freeduino



Freeduino is an open source embedded development platform consisting of a simple development board and an easy to use development environment for writing, programming and uploading codes.

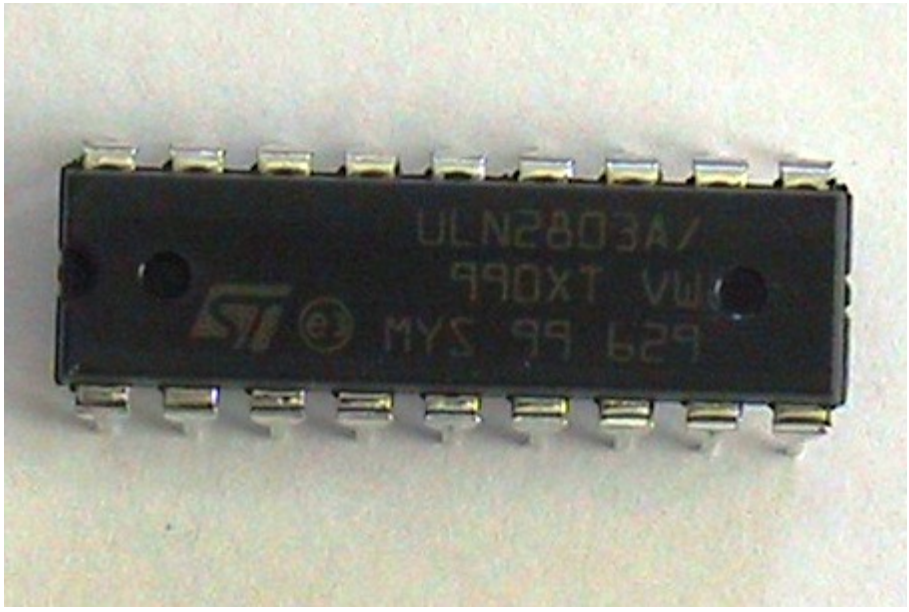
It has an Atmega8 processor with 8 kb of memory, 512 bytes of EEPROM and it is based on Arduino.

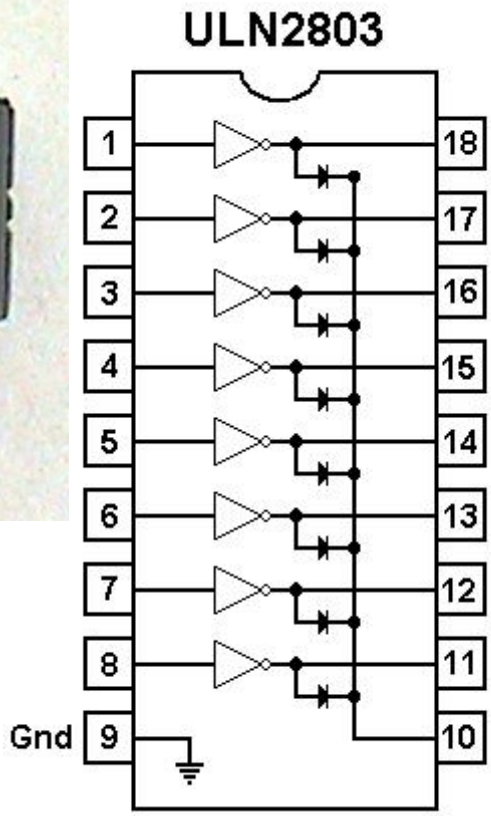
LM35 Temperature sensor



The LM35 is a high precision temperature sensor. It has a analog output, which is linearly proportional to the surrounding temperature.

ULN2803 transistor





ULN2803 is an Integrated Circuit (IC) chip with a High Voltage/High Current Darlington Transistor Array. The chip takes low level signals (TLL, CMOS, PMOS, NMOS - which operate at low voltages and low currents) and acts as a relay of sorts itself, switching on or off a higher level signal on the opposite side.

Other Components:

Other components include:

Small toy motors: These run on 12 V and draw max 750 mA. As the Freeduino couldn’t handle that load,we used a standard 12V wall wart and used ULN2803 to control the motors.

LEDs: We used small 3-5 V leds in the project.

7-Segment display: We used 7-segment LED displays to show the number of people in the rooms.

Counting the Number of people in a room

Each “step” sensor is made up of aluminium foil stuck on the two halves of a small piece of folded paper. The two pieces of foil are connected to the micro controller and the ground. However, they don’t touch unless some pressure is applied on the outer sides of the folded paper. The circuit is closed when the pieces touch and this serves as an input signal to the controller.

Two such sensors are placed inside and outside a room under doormats. When a person steps on either of the sensor, the signal interrupts the microcontroller and a counter is started. If the other sensor is activated within a specified time(default is 3s,can be calibrated as needed), the person count either increases or decreases by one depending on the order in which the sensors were activated. The count is displayed on the 7 segment led screen.
Though this system has a glaring flaw (it cant detect more than one person), it can be overcome by increasing the resolution of the sensor.

LIVING ROOM

The living room is the central part of the house.It is also the busiest part of the house. So, a stable control system is needed for the electronics.

MAIN CHARACTERISTICS

- *Automatic door that opens and closes automatically as someone steps on the sensor.*
- *A counter that counts the number of people in the room and accordingly adjusts the speed of fan and automatically switches the lights on or off.*
- *LM35 temperature sensor is also attached to the microcontroller. So, the fan speed will automatically increase when the temperature rises.*
- *An efficient 'LED TV' is also included.*

BED ROOM

The bed room is the place where a person will sleep. So proper ventilation will be needed or the person will feel uncomfortable.

MAIN CHARACTERISTICS

- *Automatic door that opens and closes automatically as someone steps on the sensor.*
- *A counter that counts the number of people in the room and accordingly adjusts the speed of fan and automatically switches the lights on or off.*
- *LM35 temperature sensor is also attached to the microcontroller. So, the fan speed will automatically increase when the temperature rises.*

The Recreation Room

This room has many common characteristics as the other rooms but what makes it different is the different noise reducing techniques used in it to reduce noise pollution.

MAIN CHARACTERISTICS

- *Automatic door that opens and closes automatically as someone steps on the sensor.*
- *A counter that counts the number of people in the room and accordingly fluctuates the speed of fan and automatically switches the lights on or off.*
- *Sound absorbing elements*
    1. *Rubber padded side walls.*
    2. *Honeycomb/hexagonal carvings on the wall on which the door is attached.*
    3. *Drapes.*
    4. *Carpeted floor.*

PHENOMENON AND EFFICIENCY

The main phenomenon is absorption of sound which takes place because sound waves lose energy on striking the dampened surfaces.

The exact absorption efficiency of an absorbing material like a porous open cell foam will be determined by a number of factors including the following:

1. *Cell size*
2. *Porosity*
3. *Material thickness*
4. *Material density*

SOME STATISTICS ABOUT THE ROOM

The room is quite effective in preventing transmission of sound out of the room. In a large room the estimated reduction in sound from these features is around 50dB which is quite significant.

The noise level exposure for 1hour is 115dB.The loudness of a rock song is around 120dB. So if in a room with similar features a loud rock music is played then it would not lead to the outsiders to get annoyed. Similarly the room from inside will be quite free from outside noises.

Green Energy

The project has integrated wind energy as a means of small scale energy generation.

Although the electricity generators shown in the project produces insignificant amount of energy but these generators can be increased in size for producing more electricity without much increase in cost.

Some characteristics about the generators used in the project.

1. It is made up of readily available and cheap materials.
2. The generators can be integrated in the domestic water pipeline for producing electricity.
3. With increase in wing span and power of the motors the generating capacity can be increased without much increase in cost.
4. Each generator produces:

- 3-4V voltage
- 50-70 mA current.
- The generation of current varies with power of motor and the wing span.
- The generated current is collectively sent through a single wire to the storage device. A diode is fitted in the circuit to ensure that the current is stored in the storage device and does not flow back to the generators.

5. The generators being small and efficient can be used on the rooftops without causing much problem.
6. They are absolutely pollution free and are made up of environment friendly materials.
7. A 1MW turbine can produce 3066 MW-h

Small-scale wind power

- Small-scale wind power is the name given to wind generation systems with the capacity to produce up to 50 kW of electrical power.
- Isolated communities, that may otherwise rely on diesel generators may use wind turbines to displace diesel fuel consumption.
- Equipment such as parking meters or wireless Internet gateways may be powered by a wind turbine that charges a small battery, replacing the need for a connection to the power grid.

This wind turbine charges a 12 V battery to run 12 V appliances.

SAVINGS

Even if 10% of households install turbines at costs competitive with grid electricity then savings are as follows.

- Study into the potential of small-scale wind energy has found that small wind turbines could provide up to 1.5 terawatt hours (TW·h) per year of electricity (0.4% of total UK electricity consumption)
- 0.6 Million tones of carbon dioxide emission is prevented.

THANK YOU