SCHOOL OF ELECTRONICS ENGINEERING

“Smart Device for Health Care Centres using Temperature Control System”

PROJECT REPORT

Submitted for the course:

Control Systems Engineering (ECE2012)

By

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CERTIFICATE

This is to certify that the project work entitled "Smart Device for Health Care Centres using Temperature Control System" that is being submitted by "Adithya Padmanabhan N", "Aditi Aravind" and "Vidwath Jagadeesh" for Control Systems Engineering is a record of bonafide work done under my supervision. The contents of this Project work, in full or in parts, have neither been taken from any other source nor have been submitted for any other CAL course.

Place: Vellore
Date: 10 April 2019

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1. ABSTRACT

In this project, we have devised a method to control the air flow of a centralized air conditioning system and thereby regulate the temperature of a room. Our model can be easily installed into existing centralized air conditioning systems and can be put to good use in hospital wards where the ambient temperature can be controlled according to the requirements of the patient's condition.

2. INTRODUCTION

Automation, along with machine learning and artificial intelligence, is playing a major role in shaping the future of the world. These disciplines have successfully brought about the 'Technology Revolution' in the world. Today, smart homes are a real thing, with technology driven by Internet of Things (IoT) making our lives more comfortable. So why should hospitals be left behind? Wards in hospitals house a multiple number of patients with a variety of illnesses. It is obvious that all these patients require different ambient temperatures for speedy and efficient recovery. The centralized air conditioning systems that are used in hospitals are not very efficient for this task with their fixed flaps. But they can be adapted to be more efficient by making adjustments to the flaps so that they can move. The movement can be varied according to the internal temperature of the patient to provide efficient cooling for the room. In this project, we look at a simple and efficient system which can achieve the aforementioned purpose.

3. METHODOLOGY

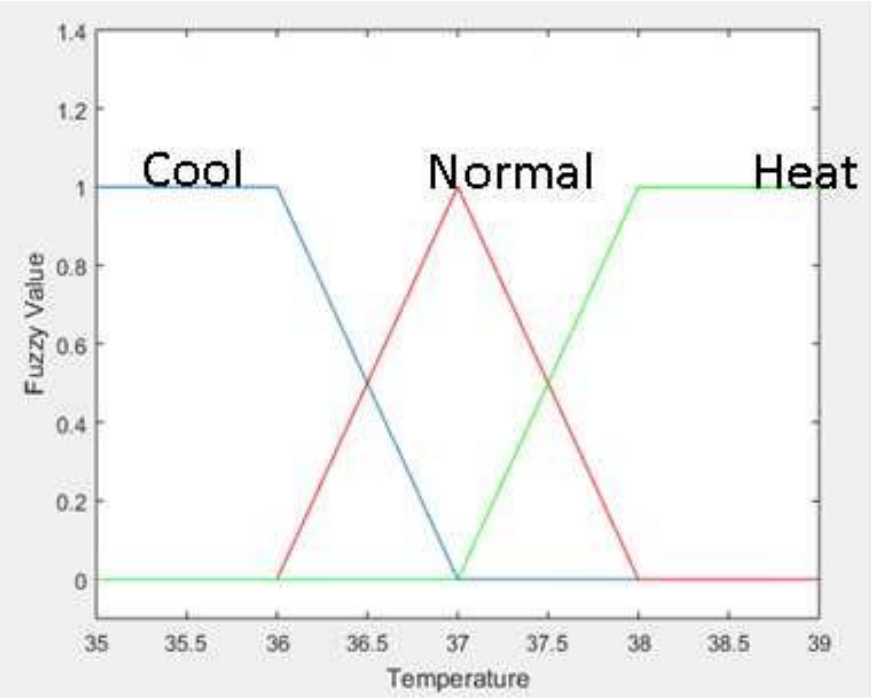
Fuzzy Logic:

Fuzzy logic is an approach to computing based on "*degrees of truth*" rather than the usual "true or false" (1 or 0) Boolean logic on which the modern computer is based.

Natural language (like most other activities in life and indeed the universe) is not easily translated into the absolute terms of 0 and 1. (Whether everything is ultimately describable in binary terms is a philosophical question worth pursuing, but in practice much data we might want to feed a computer is in some state in between and so, frequently, are the results of computing.) It may help to see fuzzy logic as the way reasoning really works and binary or Boolean logic is simply a special case of it.

Fuzzy logic includes 0 and 1 as extreme cases of truth (or "the state of matters" or "fact") but also includes the various states of truth in between so that, for example, the result of a comparison between two things could be not "hot" or
"cold" but ".38 of coldness"

The logic we used in our device was to implement fuzzy logic in the processing of temperature readings and accordingly control the motor outputs.

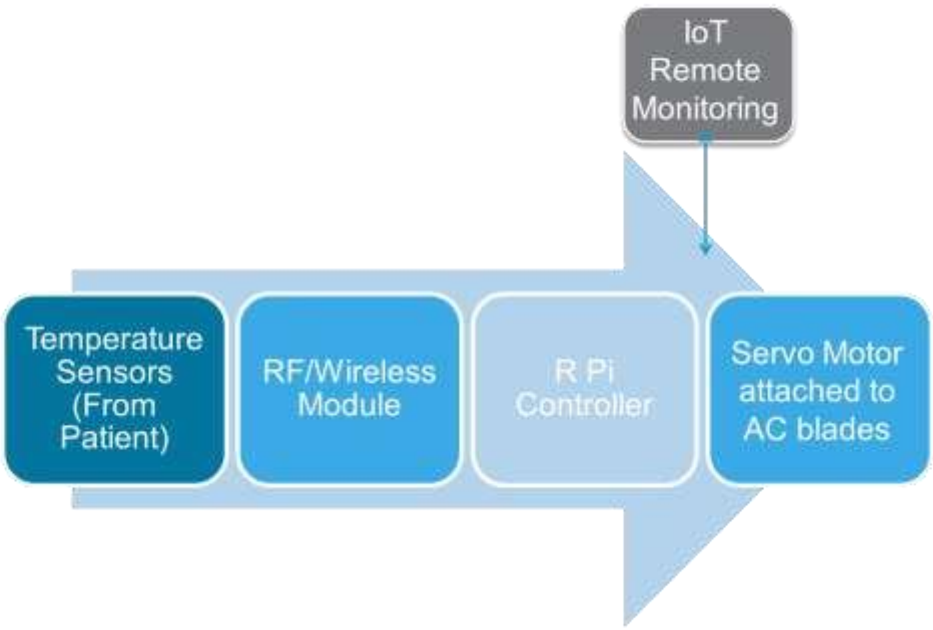


4. ALGORITHM

The following Algorithm has been implemented to ensure smooth, fast working and simplicity of the model.

- Set the default position of the flap to 45°. This will be ideal for a person whose body temperature is normal (37°±1°).
- Measure the temperature of the person
- If there is an increase in the body temperature of the person (T>38°C), Position of the flap to be increased to allow more airflow.
- If there is fall in body temperature of the person(T<36°), position of the flaps to be decreased to reduce the air flow.
- If the person’s body temperature is normal, flap remains at default opening.

The Flow chart is as follows:



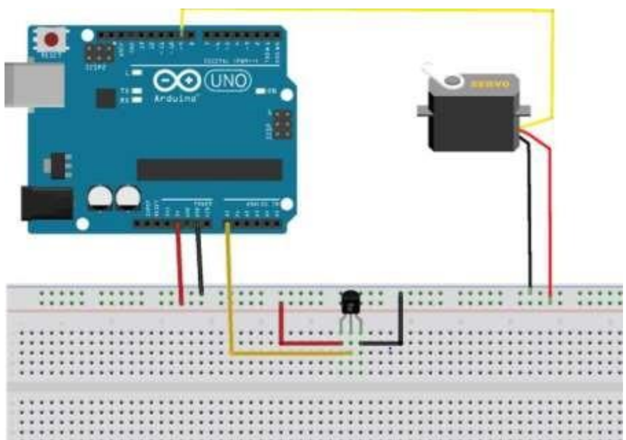
5. HARDWARE IMPLEMENTATION

The main components used in this project are the Arduino UNO, the servo motor and the LM35.

Arduino UNO: Arduino Uno consists of 14 digital input/output pins, each of which provide or take up 40mA current. Some of them have special functions like for serial communication, pins 2 and 3-which are external interrupts, pins 3,5,6,9,11 which provides PWM output and pin 13 where LED is connected. It also contains 6 analog inputs, each providing a resol+50ution of 10 bits, an ARef which provides reference to the analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

Servo motor: Servo motor works on the PWM (Pulse Width Modulation) principle, which means its angle of rotation is controlled by the duration of pulse applied to its control PIN. Basically, the servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears. **LM35:** The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius temperature. The

LM35 is operates at -55˚ to +120˚C. The LM35 can be connected easily in the same way as other integrated circuit temperature sensors. It can be stuck or established to a surface and its temperature will be within around the range of 0.01˚C of the surface temperature. This presumes that the ambient air temperature is just about the same as the surface temperature; if the air temperature were much higher or lower than the surface temperature, the actual temperature of the LM35 die would be at an intermediate temperature between the surface temperature and the air temperature.



6. SOFTWARE IMPLEMENTATION

The Code was written on Arduino IO for easy interfacing and cost-effective nature of the system.

```
#include<Servo.h>
const int powerpin=7;
int inPin = A5;
int val = 0;  int
angle=45; int
initial=73;

Servo myservo;



void setup()
{
  Serial.begin(9600);
pinMode(powerpin,OUTPUT);
digitalWrite(powerpin,HIGH);
myservo.attach(4);
  }
void loop()
{
  val = analogRead(inPin);   // read the input pin

  if (val>initial+1)
  {
    angle=90;
  }
  else if (val<initial-1)
  {
    angle=0;
  }
else   {
    angle=45;
  }
  myservo.write(angle);
delay(10);
  Serial.println(val);
delay(100);
}
```

Code: To input the temperature from LM35 and control the Servo motor accordingly

7. RESULTS

The arm of the servo motor moved in accordance with the fluctuations in the temperature picked up by the LM35. If the temperature increased, the servo arm moved towards 0 degrees from the standard of 45 degrees. If the temperature decreased, the servo arm moved towards 90 degrees from the standard of 45 degrees. The arm moved back to 45 degrees once the change in temperature was negated.

8. NOVELTY

This smart device for temperature controlling in Health Care Environments is an easy and efficient method of offering control to cool and/ or heat up a room.
Home automation devices are in demand and new technologies are coming up on the incline, and the same must be adapted for other avenues as well, such as clinics, hospitals and rehabilitation centers.

The novelty in the project is not only due to its efficient nature and costeffective advantage.
Most importantly, it can be retrofitted into most air conditioning devices, fans, heaters and ventilation systems and be integrated with cloud computing which can control and monitor the large amounts of data and act accordingly.

An added advantage is the interrupt option, which allows a manual entering of either "patient temperature" or a direct temperature required at the moment, which overrides the automated settings.

9. CONCLUSION

The circuit designed using an Arduino UNO, an LM35 and a servo motor was successful in regulating the airflow and by extension, the temperature of the room. The LM35 read the temperature of the patient, which was then processed by the Arduino and depending on the fluctuations of the temperature, the angle of the flap of the air conditioner was varied in order to increase or decrease airflow into the room. One of the main advantages of the proposed gadget is the low cost of installation as it can be easily integrated into existing air conditioner systems within the hospital.