Solar Powered Temperature-Controlled Fan with LEDs

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Summary

There are 1.2 billion people with no electricity in the world and most of people live in climates with severe heat climates. For these places, air conditioning or even a fan is hard to come. A low-cost solar powered fan will be helpful for those in need of air currents for cooling or ventilation.

Objective

For this project we will be using Arduino to control a DC fan/motor according to room temperature. A temperature sensor gives signals to the controller and the LEDs will indicate the speed of motor. this will be indicated by LED lights.

Need statement

According to International Energy Agency, "globally 1.2 billion people are without access to electricity...more than 95% of these people are either in sub-Saharan African or developing Asia, and around 80% are in rural areas." More so don't have constant or dependable electricity. This is evidence that this is a must needed product for which people will benefit from.

A. Requirements

Functionality
- Inputs
  - Temperature sensor
- Outputs
  - Seven segment display, DC motor, LED lights
- Functionality
  - After we turn on the power, the motor will run depend on the temperature, the seven segments will show which speed does the motor running and the ambient temperature taken at the time.
- Compatibility
  - Arduino has a good compatibility in adding new components, the controller circuit can be used in different system such as air conditioner, heater, mixer, etc.
- Standards
  - The motherboard will be made based on the Arduino.

Performance
- Capacity
  - Two different power supplies: 9V for the motor and 5V for the circuit boards
- Speed
  - There are five levels of speed which is depending on the signal from sensor
- Accuracy
  - Accurate to two digits
- Life in service
  - The life of this circuit primarily depends on the chips on-board which is about 2 years based on the manufacturing datasheet

Operational
- Size
  - The size of circuit is smaller than 15X20.
- Temperature, humidity
  - -40 to 85 Celsius degrees and humidity of 40 to 70%

- · Vibration, shock
  - o The motor may vibrate but it will not influence the stability of the whole parts.
- · Ruggedization
  - o All parts are covered in a shell.
- · Acoustic noise, EMI
  - o When the motor is running, some noise is likely to be produced and can be audible. Capacitors will be used to control the noise.

Economic
- · Cost to design
  - o 4 students, 2 months
- · Cost to manufacture
  - o Total manufacturing costs won't exceed $40
- · Cost of ownership
  - o Space for storage

Reliability & Availability
- · MTTF
  - o The MTTF of motor is more than 10,000 hours

Social and Cultural
- · Milieu
  - o Non-technical people (everyday families and businesses)
- · Internationalization
  - o Manual translated in desired language
  - o Understanding of solar power and the need for direct sunlight in order for it to work

Political
- · Trade barriers
  - o No trade barriers at the time being
- · Usability in union environment
  - o Non-union workers

Energy
- · Solar panel- .5W, 5V 100mA
- · Double AA batteries or 9-V battery

Health & Safety
- · No harm to anyone through manufacturing process
  - o The system will not administer any radiation or electric shock
- · One safety hazard
  - o Rotating blades could be dangerous if disturbed and anything is caught
  - o Keep away from children, don't leave children unattended around unless put out of reach

Legal
- · Non-infringing
  - o There are multiple patents on solar powered fans but we have different
- · Security and privacy
  - o No encryption will be used

Environmental
- · Sustainable practices
  - o The use of solar panel, very sustainable energy
- · Recyclability
- · Recycled Content
  - o Solar panel and batteries
- · Environmental Impact (to manufacture, to use, to maintain)

Maintainability
- · MTTR(Mean Time To Repair)
  - o Repairs upon request unavailable, for US based customers broken pieces can be replaced upon request
- · User maintainable
  - o Keep from dropping, there is a possibility of breaking
- · Recommended service intervals
  - o Batteries changing every 2 weeks or longer, depending on usage
- · Spares, instrumentation required
  - o Nothing much more needed for user
- · Remote diagnostic?
  - o Not available

Manufacturability
- · Use existing tooling, processes
  - o Arduino bootloader and Arduino IDE
  - o Number of PCB layers: 2
- · Ability to use multiple factories, subcontractors
  - o All hardware components on both of the mother board and main board either are off-the-shelf components or can be sourced from the vendors such as DigiKey or Sparkfun.
- · Use common parts, subsystems

Surface mount components for resistors and capacitors, electrolytic capacitors, 18-gauge stranded wires, male/female headers

Usability
- · How long to learn product
  - o Anyone can learn how to use the product in about 5 minutes or less
  - o May refer to manual if unfamiliar with solar panel
  - o Will not have more than two functions
- · Time required to accomplish specific task
  - o Since the circuit has the ability to adjust by itself depending on the environment, the DC motor will be adjusted in the real time
- · Common but difficult to verify
  - o It might be difficult for users to see the change in speed of the DC motor with naked eyes
- · May include typical user scenario
  - o Users might find the speed of the DC motor too strong or too weak

Documentation
- • Device installation/information/manual:
  - o Install Arduino IDE
  - o Arduino language for reading/writing the ambient temperature from the sensor, seven segment display, and motor driver

B. Marketing

Estimated Marketing Specifications
Annual sale projections
- o Estimated $250,000 in sale projections

Expected margins
- o Gross margins estimated to be over 30%

Expected Selling Price
- o $50 will be for the first version, future versions will be modified to cost less