Project planning of Automobile cabin-air ventilation device (AutoVent)

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Idea Credit: Ed Row

**Abstract**

Automotive firms that manufacture heating, ventilation, and air conditioning (HVAC) systems attempt to go beyond the technical limitations to satisfy the needs of their customers by streamlining lowering weight, size, and expense. Demanding results of a higher caliber than those of the past is, however, frequently hard to provide. Engineers and academics have paid more attention to the identification of issues, their characterization, and prognosis in relation to HVAC in the context of enhancing customer satisfaction.

The purpose of determining customer satisfaction is to meet their needs, focusing on the satisfaction of demanding customers and the desired level of performance. The tasks of quality control systems are to identify, analyze and control, based on customer reports, the main failure modes that lead to the root causes and generated problems in HVAC systems. In recent years, engineering and technological advances have progressively improved automotive thermal management. Motivational factors, the characteristics of new vehicles and their small size, the increase in the number of electric vehicles, the concern of consumers regarding fuel consumption, as well as consumer demands and political impacts have contributed to the importance of this field.

The components of a ventilation system include mechanical, electrical, and ergonomic elements. Subjected to stress, there is the possibility of reducing their life cycles and the reliability of the system must be evaluated for the purpose of planning and setting maintenance and repair tasks. The HVAC control systems in vehicles must always be developed to meet the demands of customers who want more comfort and luxury.

The Autovent will reduce stress on the cooling system, internal vehicle components, and personal belongings, while providing the user with a more comfortable experience.

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# PA1: Project Summary

Economically feasible and energy efficient devices are the need of present era. Heavy population growth also needs to fulfill heavy demand of food, energy and hygiene. As the science and technology advances, we can use new wisdom to fulfill new challenges/demands.

One of the present challenge is automobile ventilation, which needs to be energy efficient, low cost, light weight and easy to operate and handle. In this project we plan, design and fabricate an Automobile cabin-air ventilation device (named as AutoVent), which could fulfill required demands without degraded outcome.

## Description

The AutoVent is an automobile cabin-air ventilation device: it is specifically designed to cycle ambient outside air into the cabin to help alleviate rising temperatures in a static vehicle. The low voltage fan will utilize the existing cabin-air filtration system and be modulated with a thermostat and microcontroller to pump outside air into the cabin when the interior temperature reaches a set/threshold-point.

## Product Advantages

Existing competitive designs use window mounted fans, where the window must be slightly lowered, and the parked vehicle is exposed to water or dust intrusion in the event of adverse weather. The AutoVent’s integration into the existing cabin air system will allow for relatively normal day-to-day activity, where the user doesn’t need to fumble with any cumbersome devises or consider the weather. A simple comparison is shown in Table 1.

Table : Comparison of proposed device with existing options

|  | **Solar Powered** | **Discrete** | **Durable** |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## Feasibility

The design is an improvement on existing products and solves a relatively simple (yet significant) problem. It will also use common and inexpensive components; a prototype should be deliverable within the allotted timeframe. While the design specifications are in progress, the proposed materials will include a low profile and low voltage fan, microcontroller, thermostat, and photocells.

## Market

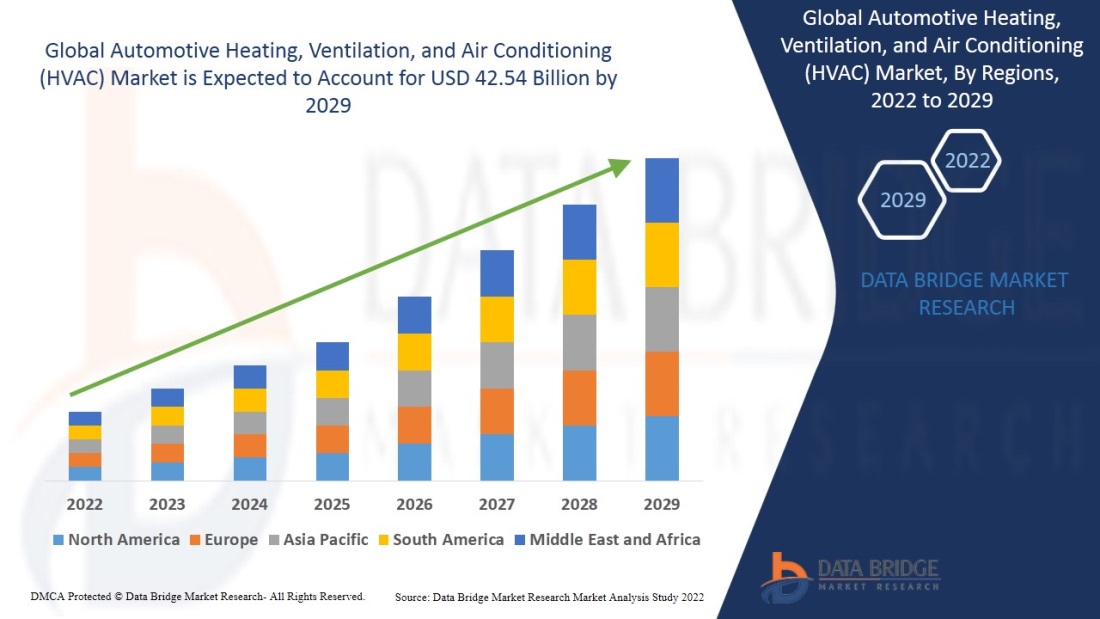
[](https://www.databridgemarketresearch.com/reports/global-automotive-heating-ventilation-and-air-conditioning-market)

Figure : Global Automobile Heating, Ventilation, and Air Conditioning (HVAC) Market Size and Analysis

Global automotive heating, ventilation, and air conditioning (HVAC) market was valued at USD 20.43 billion in 2021 and is expected to reach USD 42.54 billion by 2029, registering a CAGR of 9.60% during the forecast period of 2022-2029. “Automatic” accounts for the largest technology segment in the respective market owing to the increase in the demand for cars in developing nations. The market report curated by the Data Bridge Market Research team includes in-depth expert analysis, import/export analysis, pricing analysis, production consumption analysis, and pestle analysis [Global Automotive Heating, Ventilation, and Air Conditioning (HVAC) Market – Industry Trends and Forecast to 2029, “https://www.databridgemarketresearch.com/reports/global-automotive-heating-ventilation-and-air-conditioning-market”, April, 2022].

## Milestones

September 23, 2022 – Choose idea

* + - Secondary research to choose idea
    - Secondary research to justify chosen idea with existing options
    - Literature review to design AutoVent Idea
    - Finalizing design, materials and manufacturing process

October 23, 2022 – Complete design and material list

* + - Fitting design for selected Automobiles by literature review or by inspection
    - Market research to purchase required materials at low price
    - Workplace research to find right facility where the assembled prototype can be manufactured

November 1, 2022 – have all parts on hand, begin assembly. Troubleshoot potential design fitment issues

* + - Assembling the test product at the chosen facility
    - Learning the manufacturing process design shortcomings
    - Rectifying the shortcomings and manufacturing test samples

December 1, 2022 – Begin product testing

February 1, 2022 – Fine tune prototype

March 1, 2022 – Find suppliers and determine mass costs

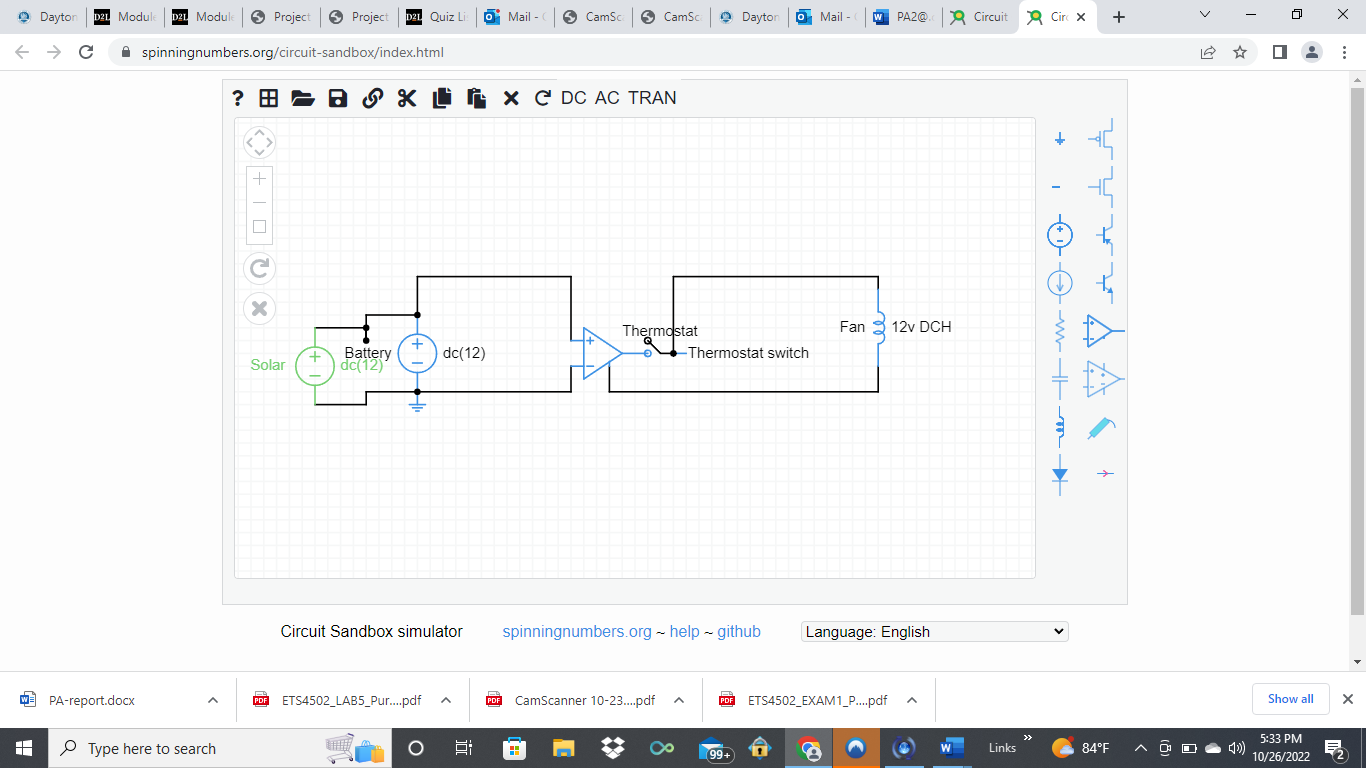
May 1, 2022 – Submit final proposal

|  |  |  |
| --- | --- | --- |
| TEAMS |  | 9 – 23- 2022 |
| Meeting Location |  | Meeting Date |
|  |  |  |
| AutoVent |  | Johnny Hughes |
| Project Name |  | Meeting Coordinator |
|  |  |  |
| Present: ALL |  | Distribution: |
|  |  | Project Team |

.

| **Item No.** | **Action items to be completed** | **Responsible team member** | **Date Action Should be Completed By** |
| --- | --- | --- | --- |
|  |  |  |  |
| 1. | Determine project | ALL | Sep. 23 |
| 2. | Secondary research ventilation system and marketing data | Hassen | Oct. 4 |
| 3. | Initial photo/drawing, research design ideas | Johnny | Oct. 4 |
| 4. | Compile template, fill in gaps in assignment instruction | Chris | Oct. 4 |
| 5. |  |  |  |

1.6 Wiring Diagram



# 

# PA2: Project details

2.1 Resources

* Manpower – 2 people to install
* 5 watt solar battery maintainer/charger
* Thermostat
* Single input / single output 12v DC controller relay
* 12v DC fan – 40mm-40mm-10mm
* Fan housing/mounting bracket (printed)

2.2 Cost Estimation

For 1 Unit:

* Labor: 2 technicians at $20 per hour, 1.5 hours = (2 x 1.5 x 20) = $60
* 5 watt solar charger = $26
* 12v Thermostat controller/relay = $7
* 12v DC brushless fan = $2
* Fan housing printing = appx $25

TOTAL direct labor, direct material, fixed, and overhead for 1 unit: **$120**

Research and Development:

* 3 technicians for approximately 10 hours each, Pro bono = $Priceless

2.3 Software Aided Planning

Using Microsoft® project the outcomes are given in Figure 2 to Figure 5.

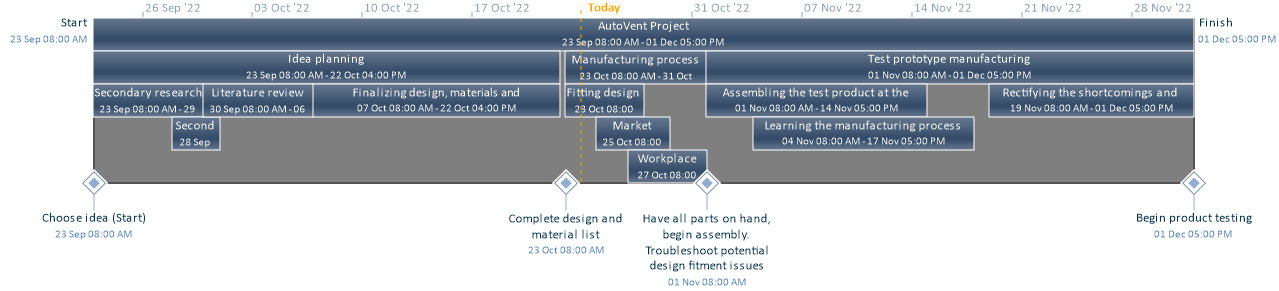


Figure : Milestones with subtasks plan

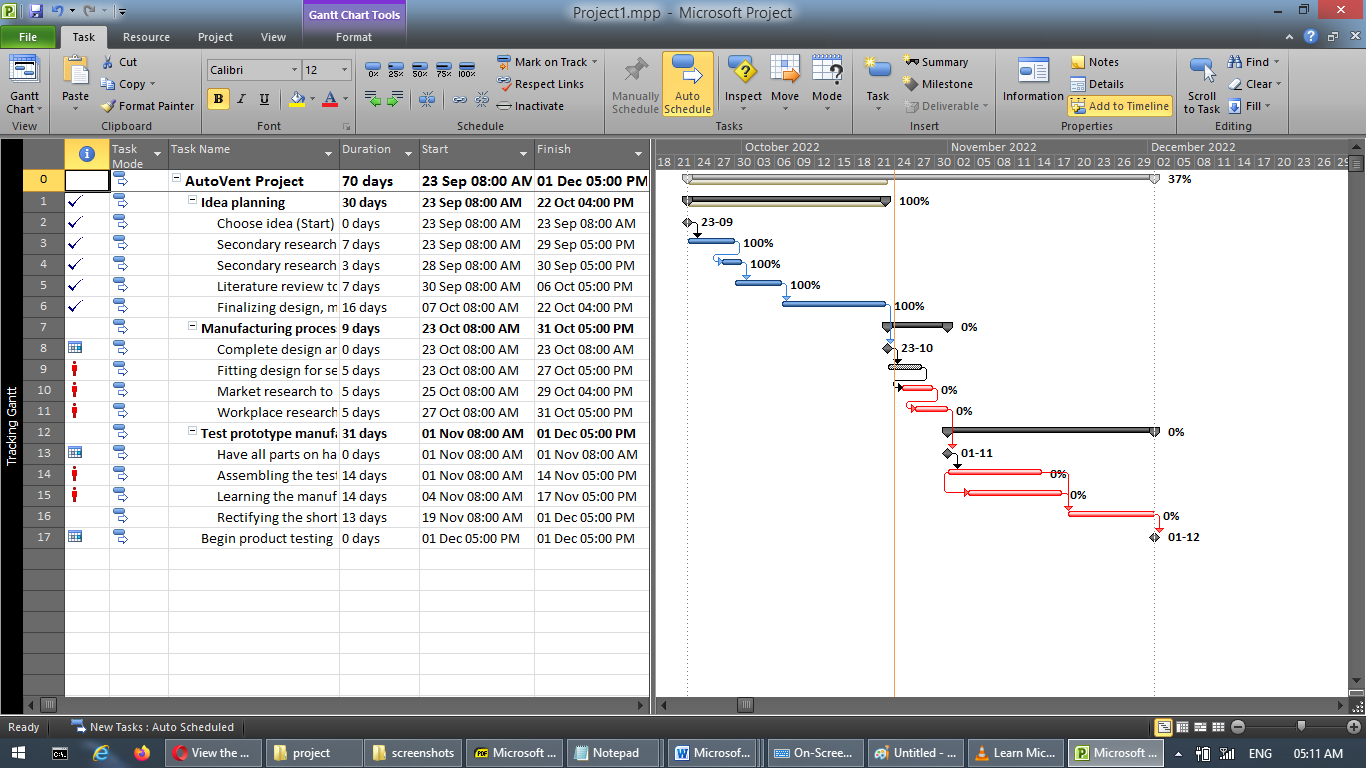


Figure : WBS with resources assignment

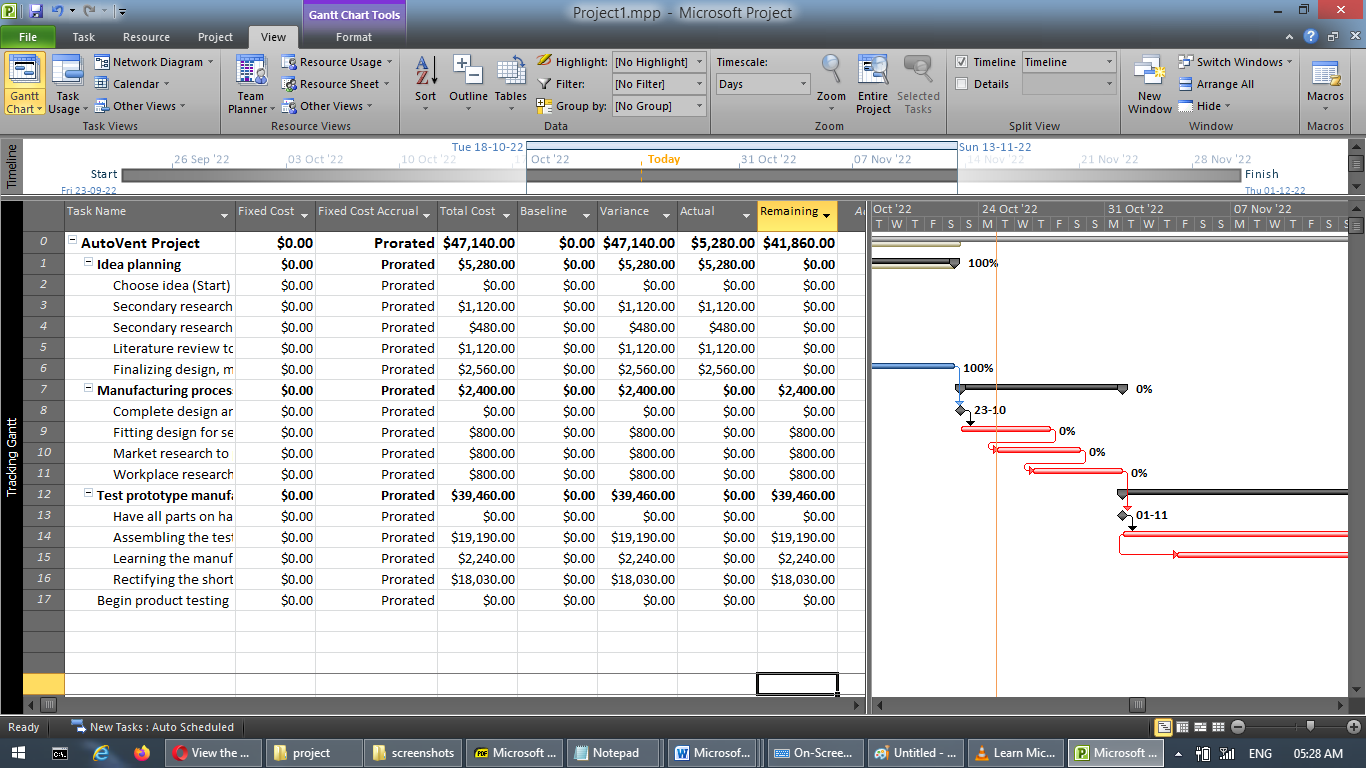


Figure : Cost estimation

89 days indicate that more than 2 researchers needed.

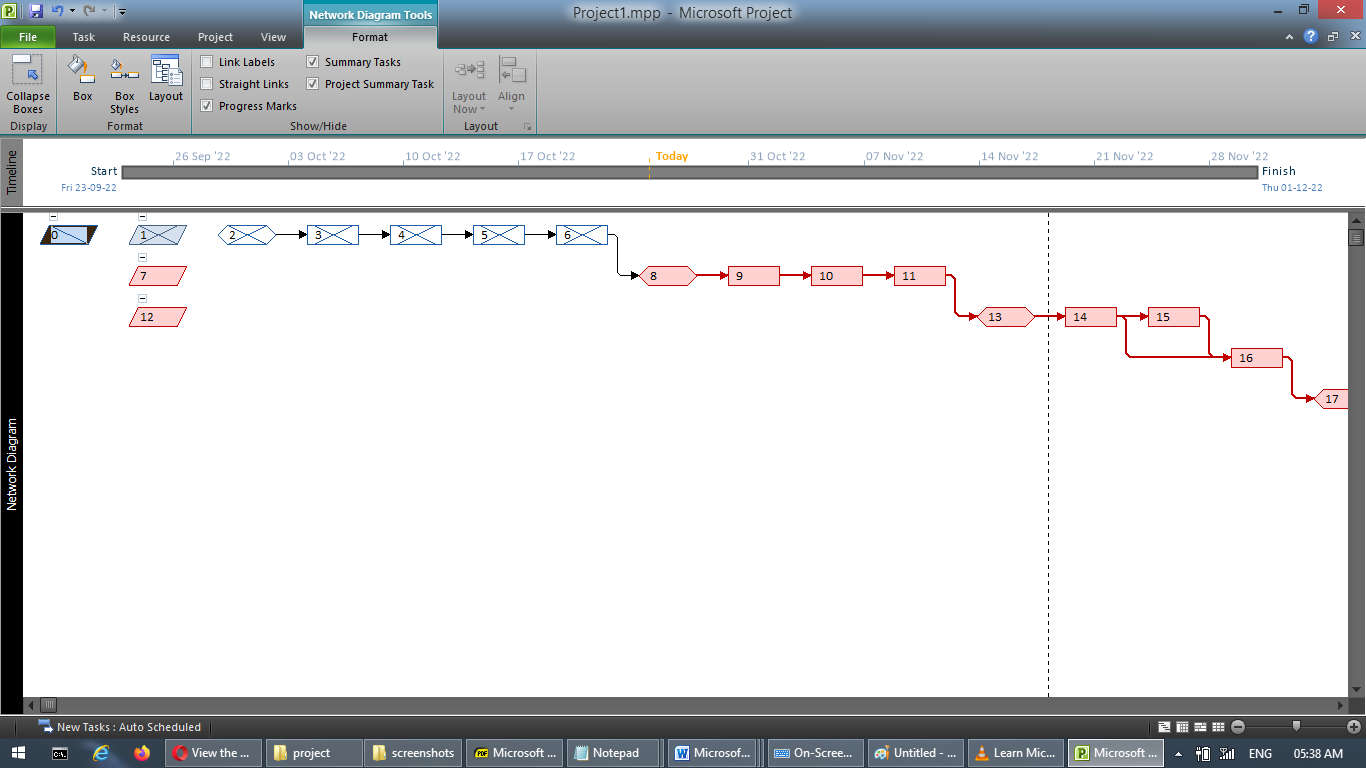


Figure : Consolidated Network view

