

HomeHawk

Team #14

Jaen Jeong
Hengsi Lin
Julian Lippmann
Yatish Patel
Sharvari Prabhu

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Mission Statement

To minimize potential damage to homes by providing a sophisticated early warning system capable of monitoring and tracking humidity, temperature and pest infestations.

Picture this scenario: You've finally paid off the mortgage on your US\$500,000 house after 5 long years. All of a sudden, during a particularly harsh winter you find some of the water pipes in your basement and attic froze and cracked resulting in significant water damage. Then, to make matters worse, the following summer you find that the floorboards are creaking much more than usual. Taking a closer look, you find one of the homeowner's worst foes – termites. These termites were attracted by wood rot resulting from excessive humidity. Overall it costs you thousands of dollars to repair all the resulting damage. To ensure that this doesn't happen again, you hire a pest control company to protect your home from termites, and decide to regularly track the humidity and temperature in various locations of your house. This costs you upwards of US\$3000, with an annual fee of US\$400. On top of the time you must invest to manually monitor the humidity and temperature, you must also arrange appointments with the pest control company to allow their technicians to inspect the installed termite devices on a regular basis.

Clearly, not taking preventative measures against the various issues mentioned above can be costly. However, even the cost and time investment required of preemptive measures can be significant. To provide a solution to this problem, HomeHawk was developed. HomeHawk always easy monitoring of important household conditions autonomously and in real time, providing a method to notify homeowners of potentially dangerous situations.

1. Market Analysis

- Termites

Termites are a major problem for homeowners across the entire United States. Damage caused by termites annually is estimated to be at about US\$3 billion¹. Clearly, there is a need to detect termite infestations so as to allow homeowners to deal with the termites before they cause a large amount of damage to the home.

Generally, there exist 3 treatment methods for dealing with termites². First, a chemical barrier can be setup around the house. This method requires technicians to create a trench surrounding the house and to drill into the masonry foundation in order to inject the chemicals. This method is costly and has a finite life span (usually around 5 years).

Second, fumigation can be performed. This method can deal with large-scale infestations (through tent fumigation), or with small-scale infestations (through wood injections). This method is costly and can be extremely inconvenient (especially tent fumigation, which requires the house-owner to prepare the house thoroughly and stay out for 3 whole days.)

Last, baiting systems can be used. This method is the most popular method, requiring the placement of termite baits at locations throughout the house. The baits are periodically

¹ <http://abcnews.go.com/sections/scitech/DyeHard/dyehard030306.html>

² <http://www.usinspect.com/WoodDestroying/termites.asp>

checked for signs of termites. When termites are detected, the baits are replaced with chemical inhibitors that will devastate the termite colony. This method is the least costly among the various methods, but periodic inspections by the pest control company have to be scheduled.

The termite detection module in the HomeHawk has been designed so that periodic inspections of the bait sticks can be avoided by using a local wireless communication network.

- Temperature and Humidity

Mold damage appears to have increased recently, particularly in Texas and other states in the south and west of the United States where heat and humidity combine to make fertile breeding grounds for mold³. Explanations for the increase include more energy-conserving building construction that prevents moisture from escaping, changes in building materials, poor quality construction and inadequate maintenance, among other things. A study conducted for the Texas Department of Insurance showed that the cost of claims for mold in that state grew from \$14.4 million in the first quarter of 2000 to \$187.5 million in the fourth quarter of 2001.

Checking multiple humidity sensors can be very time consuming and inconvenient to the homeowner. The humidity detection module in the HomeHawk has been designed so as to allow the homeowner to conveniently track the humidity throughout his house on his PC/laptop and prevent damage from molds.

- Rodent

According to the Center for Disease Control (CDC), rodents are capable of carrying multiple forms of diseases that can affect humans. Some examples include the Hantavirus⁴, and the Plague⁵. Homeowners must prevent any rodent infestations from occurring in order to protect the wellbeing of themselves and their families. Simple mouse traps are capable of decreasing the population of the rodents in the house, however, they require constant checking. Trapped rodents cannot be allowed to remain unchecked for lengthy periods of time.

HomeHawk provides a simple solution that notifies the homeowner whenever a rodent trap is triggered. The homeowner can then take quick action to remove the caught rodent.

³<http://www.caller2.com/2001/june/28/today/localnew/3923.html>

⁴<http://www.cdc.gov/ncidod/diseases/hanta/hps/noframes/rodents.htm>

⁵<http://www.cdc.gov/ncidod/dvbid/plague/>

1.1 Product

Product Description	-Home monitoring system allowing autonomous monitoring of important household conditions (humidity, temperature, rat and termite infestations)
Key Business Goals	-Create and occupy a new market niche -Serve as platform for future products -Environmentally friendly -Product introduction in 4Q 2004
Primary Market	-Home Owners
Secondary Market	-Pest Control Companies
Assumptions and Constraints	-New product platform -Widespread availability of MOTEs
Stakeholders	-Purchasers and users -Project team

Table 1: HomeHawk Information

The HomeHawk system comprises of two units. The first is the remote unit, in which the temperature, humidity sensors and modules for detecting rats and termites are incorporated. The remote unit compiles data from the sensors and transmits it to the central unit when needed. An image of the remote unit is shown below in Figure 1.

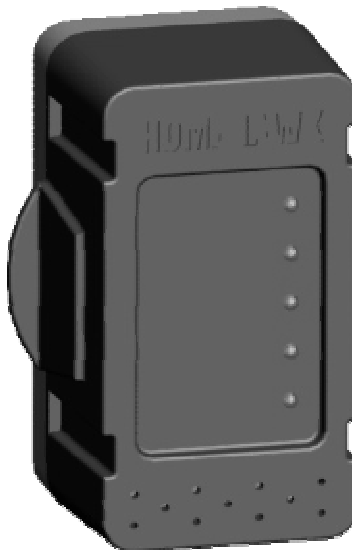


Figure 1: Image of the HomeHawk remote unit

The other unit is the stylishly designed pyramidal central unit. The central unit analyzes the data from the various sensor units and decides whether or not it should alert the homeowner. If an alert is necessary, the central unit lights up to provide visual notification of a problem. The central unit has a interface port to allow it to be

programmed from a computer. Hence, the homeowner can decide what temperatures and humidity levels are acceptable, as well as obtain graphical and statistical data about these levels over the past few days on his computer. Figure 2 below shows what the central unit looks like.

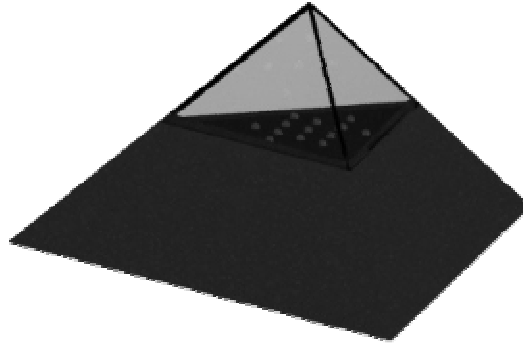


Figure 2: HomeHawk Central Unit

The HomeHawk System is operated by first installing remote units in any part of the house the homeowner would like to monitor. The remote units can be battery operated to allow for flexible installation locations, or they can be plugged in to provide longer operation times.

Once the remote units have been powered, the central unit is connected to a computer that has the HomeHawk interface program installed. The homeowner will then be guided through a configuration sequence that allows the central unit to detect the data being sent from the various remote units within range. The homeowner will also set the critical tolerances that determine when the central unit should alert the homeowner.

1.2 Sales Plan

We plan to market the system in a package comprising of the central unit, a CD that contains the software that will allow the computer to program the central unit, and 4 sensor units. With the packaging costs, we estimate the package to cost about \$90 on average (based on the forecasted cost for 2006). Following the 1:4 ratio between manufacturing cost and retail price guideline, we plan to sell the package at \$399.99.

Additional sensors will be made available at around \$50 a piece. For volume orders, we will reduce the prices to around \$40 a piece. We understand that the price ratio for these additional sensors are below the 1:4 ratio, but the profit margin for these sensors is still an acceptable 167%.

The product would be sold through the Sharper Image catalogue and other similar catalogues. We will scale up advertising to include the TV and the newsprint media when the company has established a significant customer base.

1.3 Competitive Environment

In terms of competition, we are opening up a new market niche. As of now, there are sensors that can detect temperature and humidity. There are also termite baits and rattraps in existence. However, there are no products that combine all these features into a single product.

Existing products for pest control are extremely expensive. A professional installation of termite baits can cost over \$2800, with a \$400 yearly charge for maintenance. A Do-It-Yourself installation of termite baits costs around \$60, but requires frequent inspections to be made by the homeowner. The HomeHawk system provides convenience at a relatively low cost.

Currently, there are no remote sensors available for the house to sense temperature and humidity. With the currently available sensors, the homeowner has to physically go up to the sensor and read it. With the HomeHawk system, the homeowner can track the temperature and humidity over a period of time throughout his house using the data received from the HomeHawk by his laptop without actually visiting all the portions of his house he is interested in.

1.4 Growth Plans

After the product's potential has been proven through sustained sales, we hope to be able to collaborate with pest control companies to offer improved services. By offering our device with the pest control plans offered by the companies, we can help reduce the costs for both the pest control companies and the homeowners. The pest control companies will be able to obtain data from the units remotely, eliminating the need for inspectors to arrange for costly and time-consuming monthly inspections. The homeowners will benefit from the reduced cost of the pest control plans as well as the expertise in pest control measures offered by the pest control companies.

2. Financial Analysis

2.1 Market Overview

Target Customer:

The initial target customers for the HomeHawk are the new homeowners. These are people who have just managed to save enough money to build or buy their own homes. They will be extremely proud of their new homes and will be willing to spend just that little bit more to protect their investment. They will thus be more likely to purchase the HomeHawk when they see the benefits we offer.

Future Markets:

Although we will focus on the residential property market, the HomeHawk can easily make the transition to commercial properties. After all, even commercial buildings will

experience problems with pests. However, most commercial buildings do have contracts with pest control companies for their pest control needs.

For the foreseeable future, we intend to collaborate with pest control companies. By combining our product with their existing pest control plans, we can offer our customers improved service. We can also access the commercial property market more easily with the aid of the pest control companies.

In addition, there is a large market for the product overseas. The technology required for the HomeHawk is not US-specific, so there should be no problems in selling the HomeHawk product overseas. We will definitely consider franchising the product to interested companies overseas.

Value Proposition

The HomeHawk will protect the value of the customer's investment in their property, giving them peace of mind. We must prove to our customers that our product is safe and effective without being too troublesome to use. The graphical interface and installation process is also very user-friendly. The best advertisement we can have will thus be through word-of-mouth between friends. Hence, we must ensure that we have an effective and relatively bug-free product before our initial release since the product's reputation will be very important in sustaining demand.

2.2 Market Size

Based on figures published by EuroMonitor International⁶ and the US Census Bureau, the number of single unit owner owned housing units in the US is currently estimated to be around 56 million units. Clearly, there is a large market for our product locally. With a forecasted growth of 16.9% over the next three years (or 5.3% annually), we can expect about a hundred thousand new potential customers annually.

2.3 Demand Forecast

The following sensitivity analysis calculates expected unit sales based on market share and displays the data in Table 2 below. For this analysis, we shall be conservative and assume that the market is static at the 2000 level of 115 million residential units.

Market Share	0.1%	1%	2%	5%	10%	15%	25%	50%
Sales (in thousands)	56	560	1120	2800	5600	8400	14000	28000

Table 2: Demand Sensitivity

Even with this conservative forecast, we can clearly see the potential in the market. Even if we only increase our market share by 0.1% annually, we can still expect 56,000 new

⁶ [http://www.euromonitor.com/Residential_property_in_USA_\(mmp\)](http://www.euromonitor.com/Residential_property_in_USA_(mmp))

customers annually. Since the market grows by about 5% annually, maintaining the sales level at 20,000 annually is certainly sustainable.

2.4 Manufacturing Cost and Strategy

Tables 3 and 4 below show the cost breakdown of the HomeHawk system

Unit Production Costs – Central Unit					
	2004	2005	2006	2007	2008
Raw Materials (plastics)	\$ 2.00	\$ 2.00	\$ 2.00	\$ 2.00	\$ 2.00
Mote	\$ 20.00	\$ 15.00	\$ 10.00	\$ 10.00	\$ 10.00
Electronics (Circuitry, LEDs)	\$ 1.00	\$ 1.00	\$ 1.00	\$ 1.00	\$ 1.00
Total Material Cost/Unit	\$ 23.00	\$ 18.00	\$ 13.00	\$ 13.00	\$ 13.00
Manufacturing Cost/Unit	\$ 12.00	\$ 11.00	\$ 10.50	\$ 10.20	\$ 10.00
Shipping Cost/Unit	\$ 0.50	\$ 0.50	\$ 0.50	\$ 0.50	\$ 0.50
Warehousing Cost/Unit	\$ 0.50	\$ 0.50	\$ 0.50	\$ 0.50	\$ 0.50
Total Cost/Unit	\$ 36.00	\$ 30.00	\$ 24.50	\$ 24.20	\$ 24.00

Table 3: Central Unit Production Cost

Unit Production Costs – Sensor Unit					
	2004	2005	2006	2007	2008
Raw Materials (plastics)	\$ 1.00	\$ 1.00	\$ 1.00	\$ 1.00	\$ 1.00
Mote	\$ 20.00	\$ 15.00	\$ 10.00	\$ 10.00	\$ 10.00
Electronics (Circuitry, LEDs)	\$ 1.00	\$ 1.00	\$ 1.00	\$ 1.00	\$ 1.00
Total Material Cost/Unit	\$ 22.00	\$ 17.00	\$ 12.00	\$ 12.00	\$ 12.00
Manufacturing Cost/Unit	\$ 5.00	\$ 4.50	\$ 4.00	\$ 3.75	\$ 3.50
Shipping Cost/Unit	\$ 0.10	\$ 0.10	\$ 0.10	\$ 0.10	\$ 0.10
Warehousing Cost/Unit	\$ 0.10	\$ 0.10	\$ 0.10	\$ 0.10	\$ 0.10
Total Cost/Unit	\$ 27.20	\$ 21.70	\$ 16.20	\$ 15.95	\$ 15.70

Table 4: Sensor Unit Production Cost

The manufacturing of the units will be outsourced to a low-cost overseas provider. Injection molding will be used to create the component parts, and the final unit is manually assembled. Injection molding was chosen as the Manufacturing Advisory Service on Cybercut recommended it based on the following assumptions.

Batch Size: 10,000 to 100,000
 Shape: Thinwall
 Bounding Box: 4*4*4 cubic inches
 Material: Thermoplastic
 Wall Thickness: 0.08 inches
 Per Part Cost: Low

2.5 Prototype Cost

Labor	500 Labot Units * \$39/Hr = \$19,500
Motes	\$200
Office Cost	\$15,000
Equipment / CAD cost	\$10,000
Raw Material Cost	\$200
Injection Mold Cost	\$600
Total Prototype Costs	\$45,500

2.6 Company Description

Activity Timeline

December 2003 - March 2004: Product prototyping, market research and select a group of customers to conduct pilot tests, approach VCs

April - June 2004: Secure funding and conduct pilot tests

July - October 2003: Recruit and train staff, rent offices ,marketing

November 2003: Full scale production

CEO:	\$100,000
Product Development Director:	\$80,000
Sales and Marketing Director	\$80,000
Operations Director	\$80,000 (not required first year)
Administrative Staff:	\$50,000
Software Maintenance Engineer:	\$10,000

Table 5: Company Structure

2.7 Start-up Expenses

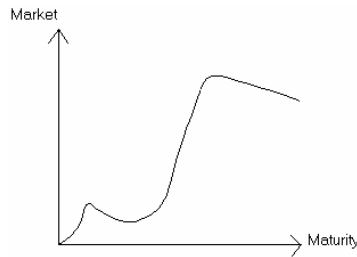
Based on NASA's Constructive Cost Model⁷ (COCOMO) for software code (see Figure 3 below), we estimate that we will need to hire an additional software programmer on a temporary basis to develop the software. The code will cost \$20,000 to develop, and \$10,000 annually to maintain.

Results		
Development Effort	2	person-months (PM)
Development Schedule	3	months
Development Cost	20000	
Productivity	500	instructions per person-month
Average Staffing	0.7	full-time-equivalent software personnel
Annual Maintenance Effort	1	person-months
Annual Maintenance Cost	10000	

⁷ <http://www.jsc.nasa.gov/bu2/COCOMO.html>

Figure 3: COCOMO Software Cost Estimator**2.8 5-Year Financial Forecast (Expected, Best, Worse Cases)**

Figure 4 below shows the general trend in market growth over the life cycle of the product.

**Figure 4: Market vs. Maturity**

From Figure 4, we can see that there are two “humps” the product will experience. The first comes from early adopters of the product, consisting of “technophiles”. Unfortunately, this market can only last a short while. The product must have sufficient appeal to the real market to attract real market adopters. This leads to the second hump. Unfortunately, the market share of the product will gradually decrease as new products are introduced and other companies begin to compete for market share.

Based on this, the group has decided on three potential customer scenarios to be considered. The worst-case scenario is that the product does not meet customer needs well. The demand for the product is projected to come solely from new homeowners, who are more willing to try out new products that can help protect their investments. We assume that only 10% of this market base will try the product for the first year. This percentage is reduced by 2 % every year. On figure 4, this can be viewed as a product that cannot get past the “chasm” as it is rejected by the real market adopters.

	2004	2005	2006	2007	2008
Sales Price	\$399.99	\$399.99	\$399.99	\$349.99	\$299.99
# Units Sold	10,000	8,000	6,000	4,000	2,000
Net Sales	\$3,999,900	\$3,199,920	\$2,399,940	\$1,399,960	\$599,980
Variable Unit Cost	\$145.40	\$116.80	\$89.30	\$88.00	\$86.80
Product Cost	\$1,454,000	\$934,400	\$535,800	\$352,000	\$173,600
Gross Margin	\$2,545,900	\$2,265,520	\$1,864,140	\$1,047,960	\$426,380
% Gross Margin	64%	71%	78%	75%	71%
Startup Cost	\$300,000	-	-	-	-
Payroll	\$320,000	\$400,000	\$440,000	\$484,000	\$532,400
Sales Expenses (10% of Sales)	\$399,990	\$319,992	\$239,994	\$139,996	\$59,998
Rent	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
Professional Fees	\$20,000	\$21,000	\$22,000	\$23,000	\$24,000
Marketing (13% of Sales)	\$519,987	\$415,989.6	\$311,992.2	\$181,994.8	\$77,997.4
Others (8% of Sales)	\$319,992	\$255,993.6	\$191,995.2	\$111,996.8	\$47,998.4
Total Operating Expenses	\$1,909,969	\$1,442,975.2	\$1,235,981.4	\$970,987.6	\$772,393.8
Pretax Profit	\$(635,931)	\$822,544.8	\$628,158.6	\$76,972.4	\$(346,013.8)
% Profit	-16%	26%	26%	6%	-58%
Cumulative Profit	\$(635,931)	\$186,613.8	\$814,772.4	\$891,744.8	\$545,731

Table 6: 5-year Profit/Loss Forecase (Worse Case)

Net Present Value (NPV) = \$586,699.55

Assumptions:

- Payroll increase by 10% from the third year onwards
- Rent is static at \$30,000
- Corporate income tax effects are ignored
- The hurdle rate for NPV is approximately 30% to approximate required VC return

The average scenario is that the product meets customer needs, but not too well. The demand for the product again comes solely from new homeowners, with 10% of this market base buying the product in the first year. This percentage decreases to 8% in the second year as the novelty of the product wears off. The market share percentage increases to 30% in the third year, 40% in the fourth, and 50% in the fifth as the product receives good reviews from customers.

	2004	2005	2006	2007	2008
Sales Price	\$399.99	\$399.99	\$399.99	\$349.99	\$299.99
# Units Sold	10,000	8,000	30,000	40,000	50,000
Net Sales	\$3,999,900	\$3,199,920	\$11,999,700	\$13,999,600	\$14,999,500
Variable Unit Cost	\$145.40	\$116.80	\$89.30	\$88.00	\$86.80
Product Cost	\$1,454,000	\$934,400	\$2,679,000	\$3,520,000	\$4,340,000
Gross Margin	\$2,545,000	\$2,265,520	\$9,320,700	\$10,479,600	\$10,659,500
% Gross Margin	64%	71%	78%	75%	71%
Startup Cost	\$200,000	-	-	-	-
Payroll	\$320,000	\$400,000	\$440,000	\$484,000	\$532,400
Sales Expenses (10% of Sales)	\$399,990	\$319,992	\$1,199,970	\$1,399,960	\$1,499,950
Rent	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
Professional Fees	\$20,000	\$21,000	\$22,000	\$23,000	\$24,000
Marketing (13% of Sales)	\$519,987	\$415,989.6	\$1,559,961	\$1,819,948	\$1,949,935
Others (8% of Sales)	\$319,992	\$255,993.6	\$959,976	\$1,119,968	\$1,199,960
Total Operating Expenses	\$1,909,969	\$1,442,975.2	\$4,211,907	\$4,876,876	\$5,236,245
Pretax Profit	\$(635,931)	\$822,544.8	\$7,787,793	\$9,122,724	\$9,763,255
% Profit	-16%	26%	65%	65%	65%
Cumulative Profit	\$(635,931)	\$186,613.8	\$7,974,406.8	\$17,097,130.8	\$26,860,385.8

Table 7: 5-Year Profit/Loss Forecast (Expected Case)

Net Present Value (NPV) = \$21,412,804.64

The best-case scenario is that the product fully satisfies customer needs. The demand for the product is again projected to begin at 10% of the new homeowners in the first year, decreasing to 8% in the second due to the effect of novelty. In the third year, the demand increases to 40% of the new homeowners market and 5% of the existing homeowners market as favorable customer reviews encourages more homeowners to try out the product. In the fourth year, the demand increases to 60% of the new homeowners market and 10% of the existing homeowners market. In the fifth year, the demand increases to 70% of the new homeowners market and 20% of the existing homeowners market.

	2004	2005	2006	2007	2008
Sales Price	\$399.99	\$399.99	\$399.99	\$349.99	\$299.99
# Units Sold	10,000	8,000	140,000	260,000	470,000
Net Sales	\$3,999,900	\$3,199,920	\$55,998,600	\$90,997,400	\$140,995,300
Variable Unit Cost	\$145.40	\$116.80	\$89.30	\$88.00	\$86.80
Product Cost	\$1,454,000	\$934,400	\$12,502,000	\$22,880,000	\$40,796,000
Gross Margin	\$2,545,900	\$2,265,520	\$43,496,600	\$68,117,400	\$100,199,300
% Gross Margin	64%	71%			
Startup Cost	\$200,000	-	-	-	-
Payroll	\$320,000	\$400,000	\$440,000	\$484,000	\$532,400
Sales Expenses (10% of Sales)	\$399,990	\$319,992	\$5,599,860	\$9,099,740	\$14,099,530
Rent	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
Professional Fees	\$20,000	\$21,000	\$22,000	\$23,000	\$24,000
Marketing (13% of Sales)	\$519,987	\$415,989.6	\$7,279,818	\$11,829,662	\$18,329,389
Others (8% of Sales)	\$319,992	\$255,993.6	\$4,479,888	\$727,9792	\$11,279,624
Total Operating Expenses	\$1,909,969	\$1,442,975.2	\$17,851,566	\$28,746,194	\$44,294,943
Pretax Profit	\$(635,931)	\$822,544.8	\$25,645,034	\$39,371,206	\$96,700,357
% Profit	-16%	26%	59%	58%	69%
Cumulative Profit	\$(635,931)	\$186,613.8	\$25,831,647.8	\$65,202,853.8	\$161,903,210.8

Table 8: 5-Year Profit/Loss Forecast (Best Case)

Net Present Value (NPV) = \$101,157,562.24