TERMITE INFESTATION PROBLEM

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Abstract

To detect termite infestation at household, people seek professional help in the initial stages which leads to significant costs up to £500. Market Research indicates that 2% of the homes in London seek help from local pest control agencies and consequently, incur the aforementioned costs. Therefore, the aim of this project is to design a device that people can use to detect termite infestation before calling professional help and would consequently, save user hassle and experience. The latter has to be certainly used when the presence of termite swarm is definite.

The first section of this report will look at the problem statement followed by the market research wherein the idea of not seeking professional help isn't required in the first place will be reiterated. Finally, the section of project development will look at the technical details and the concepts from the modules that will be used to implement this project.

1. Proposal

Terminix, a pest control infestation business set in the United States, estimates that annually, termites cause $5 billion in damages and repair costs. Around, 4 million homes in the United States are at risk of termite infestation each year [1].

But a smooth process of termite detection in the first place is also significantly, a greater problem.

A: Problem Statement

Termite infestation is an issue of global significance and causes three major problems in this situation:
a: They are extremely difficult to detect in a common household and failure to take immediate action has severe consequences.
b: People commonly seek professional help in the initial stages in the process of detection
c: False detection could lead to further uncalled costs by dismantling of the household such as wooden floors.

Through an implementation of various Electronics concepts, the group aims to design a device that will firstly, increase the accuracy of the detection of the termites located in inaccessible areas such as the ceiling.

Secondly, this device would be able to detect the infestation without dismantling the household. Finally, and most importantly, people can use this device as the first step in the process rather than seeking professional help in the initial stages and consequently, this will reduce hassle. Certainly, the help from pest control agencies is required when the presence of termite swarm is definite.

B: Market Research and Business Case

In London, approximately 3.3% of homes are vulnerable to this catastrophic invasion and go unnoticed. Moreover, 1.5% of homes seek professional help for the purposes of detection in the first place. Finally, 2.2% of them dismantle the household based on false readings [3]. Consequently, this device will target the aforementioned three markets.

C: Competitor Analysis

There are several different methods of detecting termites, all assisted by technological advancements. The market is occupied by expensive tools and professional agencies that charge exorbitant amounts as the average person has little knowledge about termites.

- **Moisture Meters and Termite Tapper:** Moisture meters are based on the fact that termites thrive in damp surroundings. Therefore, a higher than normal moisture level can be indicative of termite activity.

  However, this is inconclusive given that high moisture levels could be present due to a variety of reasons including leaking pipes. Consequently, they often provide inaccurate readings leading to expensive useless procedures.

- **Thermal Imaging:** Thermal sensors detect changes across the surface of a wall which can suggest an infestation in warmer areas. Expensive thermal ranging cameras are also used but they can be replaced by an infrared thermometer.

The above processes need to be intertwined to conclude the presence of termites with absolute certainty. These long and tiresome processes often prove to be expensive along with the trouble of seeking professional help from a pest control agency. Costs incurred include buying a Termatrac Detector which costs £3778 and the average cost of a local pest control would charge a service fee of £325 [2].

Therefore, there arises a market of people who wish to conduct their own tests that provide greater certainty about the presence of termite infestation before contacting professional pest control agencies.

2. Project Development

A: Objectives

Through extensive planning and discussion, the following objectives of this project were defined:

- To develop an affordable electronics-based device to allow termite infestation detection without calling professional help in the initial stages
- Simplify the complexity of the problem by employing more technical concepts from Year 2
- Regular group discussions to ensure constant progress of each area of the project and to stick with the timelines defined in Section E

B: Resources and Expertise

The project will include an IR temp sensor, Microwave emitter and receiver and possibly a moisture sensor based on an Arduino board. The following resources and facilities at Imperial will be available for use:

- *Electronics Lab* – Since the Electronics Lab at the department is very well equipped, all the circuits and prototypes will be built and tested in the lab.
- *Department of Chemistry & Biology:* To enhance the knowledge of bodily functions of the swarm of termites.

C: Technical Mapping

Circuit Analysis, Analogue Electronics and Control Engineering: Firstly, concepts of Circuit Analysis will be used extensively to connect sensors to each other. Furthermore, the integrated concepts of Circuit Analysis and Analogue Electronics, such as the ones explored in the Microelectronics Labs in Year 1 will be heavily used. For instance, op-amps will be used to amplify weak signals and other signal processing skills be useful.

Software Engineering: Concepts explored under the Microcontrollers experiment in Year 1 such as Arduino Board programming using C++ will be used. To further tackle the intricacies of the problem, few concepts of machine learning intertwined with the Arduino will be used to detect termites from various heat emitting bodies present behind the walls.

Natural Sciences: To tackle this problem it is important to understand the Biology and Chemistry behind how termites exhibit these detectable properties in order to successfully employ this project.

D: Project Planning

The group of eight members have been allocated into roles as follows:

Project Manager: Sanjana
Module Sub-Group 1 - Circuit Design and Implementation: Sanjith, Raj, Yinzi, Ammar
Module Sub-Group 2 – Software Engineering: Kanav
Module Sub-Group 3 – Product Prototyping: Sanjana, Snehil, Linghzi
Secretary and Treasurer: Raj

The group uses WhatsApp for instant messages along with Google Drive for a file sharing system. Additionally, regular meetings will be taking place every week with each one lasting for an hour. For the purposes of decision making, the matrix method learnt in EDP in the first year will be employed. Finally, module sub-groups overlook each other's progress to ensure the progress is on track.

E: Timelines

The following timelines have been defined by the team:

- Beginning of Autumn Term; Weeks 2 – 6: Feasibility Study, Response, Research, Learn Skills
- Middle of Autumn Term; Week 7: Define Engineering Design Criteria and Product Design Specification
- End of Autumn Term: Preliminary Report
- Beginning of Spring Term: Stage 1 - Circuit Design and Implementation, Arduino Programming and Product Prototyping
- Middle of Spring Term: Implementation of PDS, ordering parts, and Stage 2 of Prototyping
- End of Spring Term: Final Stage – Testing, Poster Print, Demo, Poster Presentation and Final Report
- Beginning of Summer: Portfolio, Peer Assessment

3. References

1) https://www.terminix.com/termite-control/faqs/
2) https://termatrac.com/
3) https://www.pestcontrol.co.uk/index.php