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PROGRESS REPORT

Up until now, our proposed plan includes the following tasks:

Research
Proposal
Functional Specification
Design Specification
Detection of Fire
Motor Control
Casing design

RESEARCH

A majority of our time during the beginning of our project was heavily invested in research for both the mechanical and electrical aspects of our project. Although we have found products similar to our project at Unifire.com, they focus on large scale fire fighting systems that can cause a lot of water damage in smaller spaces, such as an average sized room in a house. For our FlexiSys product, we aim to design a smaller scale intelligent firefighting system that can minimize water damage.

Research has been split up into several special areas of the system. Our hardware and mechanical engineers have been researching on hardware components, structural designs, and water pressure issues. Our software and electronics engineers have been investigating fire fighting sensors and electronic circuits. The research has gone well so far and will continue until the end of project.

PROPOSAL, FUNCTIONAL SPEC, DESIGN SPEC

In order to properly document our research, three major documents have been written for the goals, requirements and designs of the project. Our product, the Flame Extinguishing Intelligent System (FlexiSys), is designed to be used in an average small room, approximately an area of 3mx3m. In order to analyze our product from a high level design, requirement analysis has also been completed in our functional specification documentation. For more detail, the overall system block diagram was submitted in our design specification. From that block diagram, our team has separated the overall design into different partitions based on labour characteristics: Our electronic system includes sensors, microcontroller, solenoid water valve and motors. Our hardware system includes designs for the casing, sensor stack, and water gun. While our system is not fully completed, the degree of completion with respect to the functional specifications for our proof-of-concept system (priority 1) has been on track and expected with our Gantt chart.

DETECTION OF FIRE

The FlexiSys team has completed research on thermal meter sensors, imaging sensor, thermal arrays, and image processing for fire detection. However, after the discussion with appointed technical teaching assistant for this course as well as emails exchanged with Parallax technical customer support, our group had decided to use infrared sensors to detect heat signatures from fires. Our Chief Software Engineer (CSE) had studied thermal meter module MLX90614. We have purchased and tested these modules and verified that they are able to read heat signature from flames within 3-4 meters. These modules can communicate through serial data ports with our selected microcontroller, the Arduino Mega. We had originally encountered problems with insufficient connections on our smaller Arduino board, the Duemilanove. Through research, we overcame this problem by programming general digital I/O ports to be extra soft-serial connections. As of March 22, we are able to detect fires from all the sensors and preliminary integration with one motor has been accomplished. Further work will implement all the motors and casing to determine the speed of rotation of our system.

MOTOR AND WATER GUN CONTROL

To control the water flow and the release of water, solenoid water valves have been purchased. The valves require 12V of voltage supply so extra circuits had been built and the valves are tested to be working. For our water gun and sensors movements, our whole group agreed to purchase servo motor SPG425A set and gears from servocity.com. After receiving the package, we realized our servo motor set was unassembled. As a consequence, we had to spend an extra day to understand the servo motor set schematics and had to construct the servo motor units. This extra work, however, gave us opportunity to gain more knowledge of servo motors structures and functionalities.

CASING DESIGN

Our mechanical and hardware engineers had completed theoretical physical designs for the overall system. We have Solidworks' models of our hardware casing, sensor stack mount and water gun holder. Many meetings have been held to ensure physical hardware designs are correct and can support our electronic components. Currently, we are building these hardware components. The lack of proper and ideal pieces for our project caused a lot of headaches and frustrations. After spending countless hours visiting different general hardware stores to specialized part stores, we finally managed to obtain enough material to build something to what we had envisioned. Our current goal is to have prototype completed by the end of this up coming week. The rest of the time, we will spend them on testing, debugging and modification as planned.

BUDGET

Our budget proposed was $734.57, and we have currently spent roughly $900. Unfortunately, sensors and motors are far more expensive than we originally expected. In this $900, we spent about $500 on motors, gears, shaft and clamps, $300 on sensors, and $100 on accessories, such as water pipes, bearings, valve, controller, glues, etc. However, we have obtained most of required components. Although we have received $500 funding from the ESSS, we will try to apply for the Wighton Fund to cover the extra cost. If we don't receive funding from the Wighton Fund, all the members of this term have agreed to share the rest of the expenses.

HUMAN RESOURCES

Despite irregular time schedules and differing opinions, group dynamics are still healthy. As each member has a tremendous amount of workload this semester, conflicts did occur in the group from time to time. Fortunately, all problems were resolved quickly and an agreement obtained. Part of this project has created professional bonds between each student and respect for each other has grown as well.

ACTION ITEMS

March 22nd is the fourth milestone date for our FlexiSys design. By this time, we will have finished the research, fire detection algorithms, motor controls and casing designs. Currently, we are still on schedule. We aim to have the completed prototype at the end this week while the rest of the time (until April 15th) will be spent on testing, debugging and improvements.