PROGRESS REPORT

Overview

Over the last few months, Auto Tech has managed to meet most of the design and functional requirements for the Human-Chasing Robot. We are currently at the integration phase where we are combining the transducers and the robot kit.

System Level Analysis

Robot Unit

We purchased the BOE-Bot robot kit by Parallax Inc. and assembled the robot. The continuous servos that came with the robot kit were tested and a short program was written in PBASIC for centering the servos. We were successful at controlling the movement of the robot using the two continuous servos. The robot can move forwards, backwards and turn freely at various speed. We also tested the communication between the microcontroller and external sensors. The microcontroller can read input signals from the I/O pins and navigate the robot.

Future Steps:
The movement of the robot is functional on its own. We need to integrate the wireless communication part with the robot for navigation using the wireless beacon. Since the ultrasonic sensors are not yet ready for integration, we can also start by writing subroutines for movement controls. We can create subroutines for moving left, right, forward, and reverse. Once integration begins, the algorithm for navigation can call these subroutines. This would reduce the time needed for integration.

Wireless Communication Circuit

According to our "Functional Specification" we need two Ultrasonic sonar sensors as receiver and a tracking beacon as transmitter. At the beginning, we built a receiver and a transmitter. However, the range was too short: the receiver only can receive signal within around 10cm. In order to get a larger range, we built a new receiver base on a product on eBay. Our new receiver works well and rang up to around 2m. However, there was another problem, if there was an angle between receiver and transmitter, the quality of signal became unclearly, the larger angle they have the worse signal we get. In the result, we decide to change our expectation: instead of using two receivers we will use three to ensure our robot could find the target quickly and accurately. Furthermore, we built our circuits on our breadboard and it takes a lot of space. However, the receiver and the transmitter on eBay have a small size. Considering the size of our

robot we decide to use the product from eBay. So, we bought three receivers and one transmitter. However, the receivers we bought didn't work well. Finally, we decide to use our own circuit.

Future steps:

After receiver receives signal, the signal will be transferred to microcontroller then microcontroller will command the robot to move. We decide to build another circuit to convert the square wave signal that receiver get to a 5V line signal. So, for example, if the microcontroller receives a 5V line signal from left receiver it will tell robot to turn left. We still need to find the way to tell the robot stop at an appropriate position like 1m away from the target.

Video Streaming Unit

The core functionalities of the video streaming unit are all implemented and working as we proposed. We first purchased the Raspberry Pi, which is the main processor for the system. Then, we got an SD card and installed Raspbian, Linux distribution customized for the Raspberry Pi. After we successfully booted up the Raspberry Pi, we attached the USB wireless adapter and the webcam to the Raspberry Pi. Finally, we installed three applications to enable the streaming service. Hostapd was installed to let the Raspberry Pi behave as a Wi-Fi access point, dnsmasq was installed to provide DNS and DHCP services, and MJPG-Streamer was installed to stream the video through a webpage. We looked into other applications as well but the streaming performance was the best with these applications.

Future steps:

The unit is not tested with the battery power yet. It should run fine with the battery power but it needs to be tested to make sure it works with the battery power. Other than this, no more work is required for this unit.

Budget

By purchasing the Parallax Boe-Bot kit, we were able to bundle the cost of the movement components and the microcontroller. We separated the video streaming component from the robot movement control so we needed to purchase a second microcontroller. We chose to use the Raspberry Pi microcontroller because of its low price. For the most part, cost the video streaming unit is close to our initial estimate. The cost of the wireless communication unit is hardest to control due to changes in the design. We spent some money on different ultrasonic sensors and components trying to achieve the results we want. We have yet to find a solution for the wireless

communication unit so we project the cost will continue to increase. Overall, we are still operating within our initial forecasted $500 budget.

Human Resources

The members of Auto Tech are still maintaining a healthy relationship and showing respect towards each other. Weekly meetings are held to ensure the project is not behind the schedule.

Action Items

December 10th is the final milestone date for the team working on the tracking robot to deliver the proof of conceptual model. The robot will be tested thoroughly to ensure all function specifications are met. Currently we are working on the robot movement by reading the data from the transducers. We are going to conclude the testing phase by testing sharp turns and running into obstacles. It is important to ensure the prototype is going to function properly and safely in different scenarios.