



ROBOT COMPETITION SOUTH EAST CONFERENCE 2006

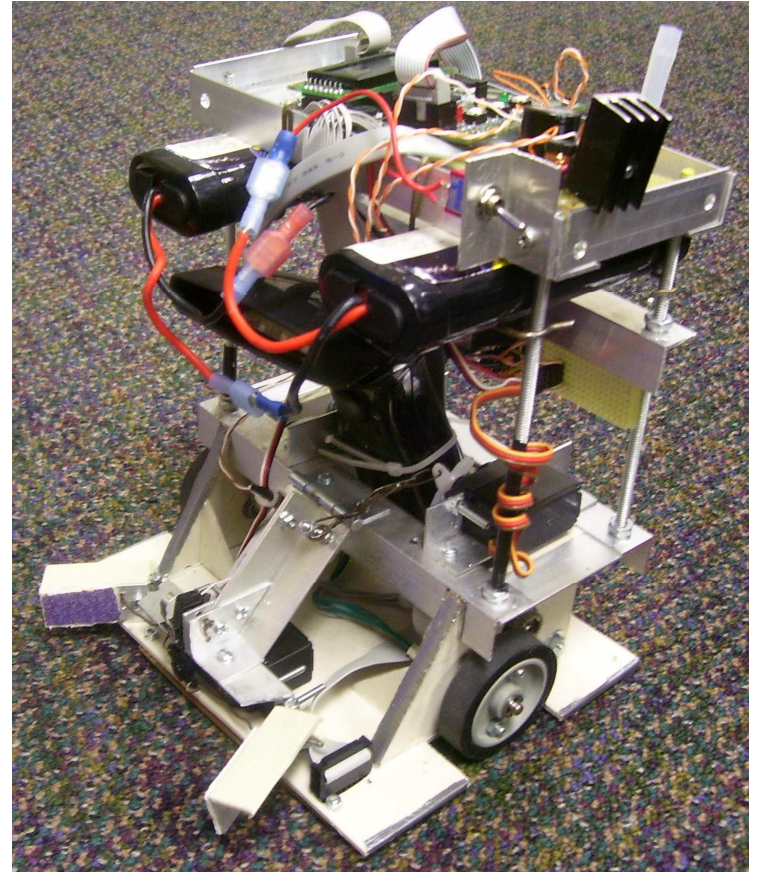
JOHNNY BOLANO

CRESSEL ANDERSON

JAMES WU

MAXWELL

- AUTONOMOUS
- 2D MOVEMENT
- LINE FOLLOWING ABILITIES
- BAR-CODE SCANNING
- GRIPPING AND LIFTING ABILITIES
- SIZE
 - 7 7/8" LONG
 - 7 5/8" WIDE
 - 9 1/2" HIGH



MAXWELL

□ ON-BOARD SYSTEMS

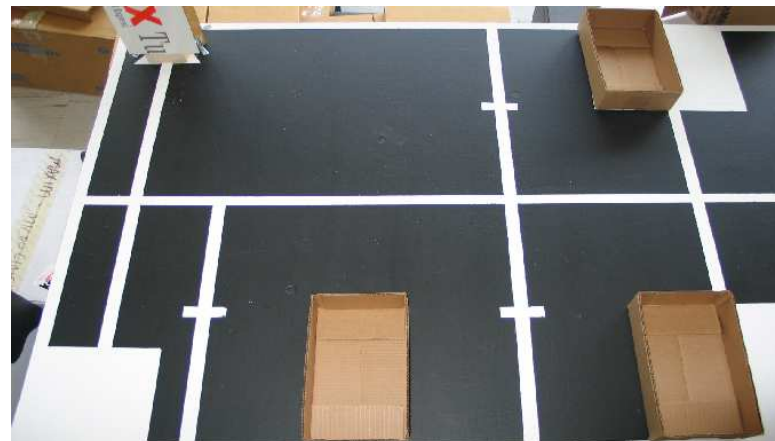
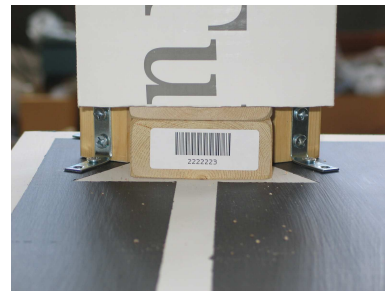
- GRIPPING ARM
- EYES
- MANEUVERING
- SCANNER

□ INTEGRATION OF SYSTEMS

- RENESAS M16C

DESIGN REQUIREMENTS

- AUTONOMOUS PACKAGE LOADING ROBOT
- MUST REMOVE 12 PACKAGES WITHIN 6 MINUTES
- 3 PLANES TO LOAD
 - PLANE 1: 3 MINUTES
 - PLANE 2: 4 MINUTES
 - PLANE 3: 5 MINUTES



DESIGN CONSTRAINTS

□ INITIAL SIZE OF THE ROBOT

- 8" LONG
- 8" WIDE
- 12" HIGH

□ EXPANDING SIZE OF THE ROBOT

- 14" LONG
- 14" WIDE
- 20" HIGH

MANEUVERING

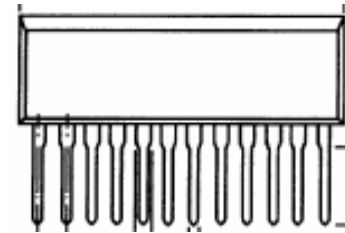
□ UNIPOLAR STEPPER MOTORS

– DRIVER

□ 2 MP4303 FOUR DARLINGTON POWER TRANSISTORS

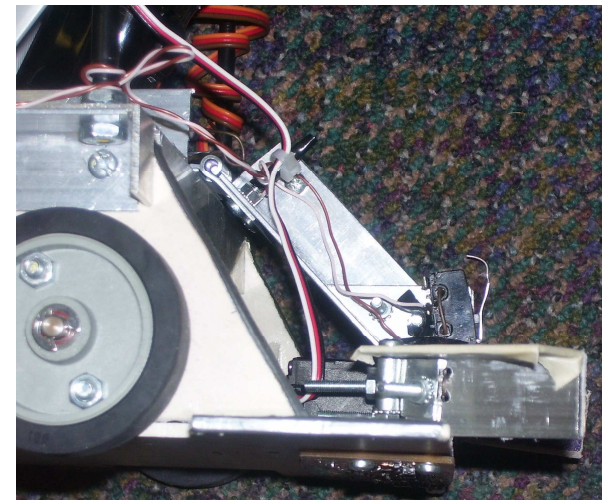
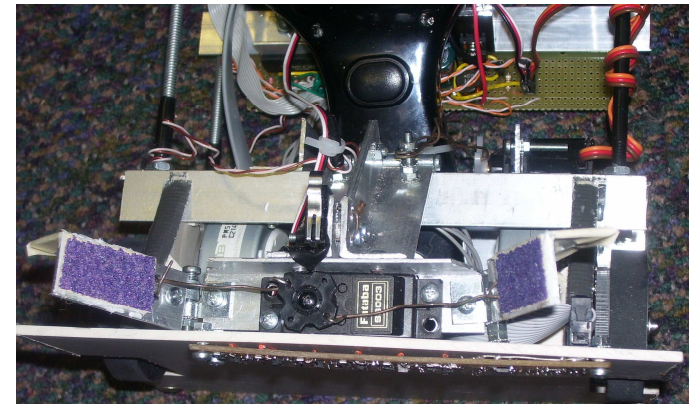
□ INPUT VOLTAGE $14.5 \text{ V} \pm 1 \text{ V}$

□ INPUT CURRENT PER COIL $\sim 1 \text{ A}$



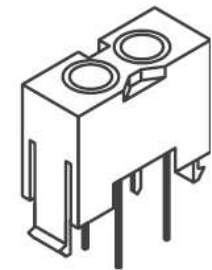
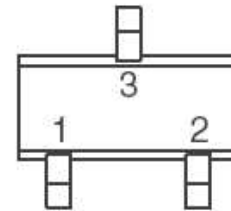
GRIPPING ARM

- SAND PAPER 60 GRIT
- SERVO MOTORS
- CONTROLLED BY RENESAS MI6C PWM OUTPUT
 - TIMERS A1 & A2
- INPUT VOLTAGE 5 V
- JR SPORT ST125MG
 - 145 OZ/IN
- FUTABA S3003
 - 56.8 OZ/IN



EYES

- HEX BUFFER
 - MC14050BDR2
- NPN TRANSISTOR
 - 6 PMBT2222A T/R
- 12 200 Ω RESISTOR
- REFLECTIVE PHOTOINTERRUPTER
 - 6 GP2S700HCP



EYES

□ DIFFERENTIAL FEEDBACK CONTROL

- USED TO FOLLOW LINE (GUIDANCE SYSTEM)
- USED DIFFERENTIAL GAIN FOR VARIATION OF VELOCITY OF LEFT OR RIGHT MOTOR
- DEVELOPED USING MOVING AVERAGE OF PRECEDING VALUES ATTAINED
- USED IN DYNAMIC TURNING

SCANNER

- CCD SCANNER MODEL DS-800
 - UART COMMUNICATION
 - INPUT VOLTAGE: 5 V
 - CONTINUOUS SCAN (NO TRIGGER)

BRAIN

□ RENESAS MI6C

– CONFIGURATION

- 24 MHZ INTERNAL CLOCK
 - PLL TIMES 2
- 2 PMW TIMER A1 & A2 FOR SERVO MOTORS
- OUTPUT PORT P4 TO CONTROL STEPPER MOTORS
- UART
 - 8 BIT
 - 19200 BAUD RATE
 - 1 STOP BIT
 - NO PARITY
- 6 ANALOG INPUTS
- 6 ANALOG TO DIGITAL CONVERSIONS OF ANALOG INPUTS
- P3_6 BLUE LED (BLU_LED)
- P3_7 SWITCH 4 (S4)



BRAIN

□ CODE DEVELOPMENT

- SEPARATE .C FILES FOR EACH SYSTEM
- INTEGRATION OF SYSTEMS USING ROUND ROBIN SCHEDULER

□ DIFFERENT ACTION PERFORMED DEPENDING UPON STATE
(STATE MACHINE)

SAMPLE CODE

```
/* pass 1st plane exit */
if(state == 22){
    followline();
    counter++;

    // Search for intersection, if found state = 24
    if(intersection_type == 1 && counter > 60){
        intersection_type=0;
        counter = 0;
        state = 24;
        printState(24);
    }
}

/* Head towards box #2, turn right */
if(state == 24){

    followline();
    counter++;

    // Search for short intersection, if found state = 9
    if(intersection_type == 1 && counter > 60){
        // Disable Task 1, 2
        Task_Enable(1, 0);
        Task_Enable(2, 0);
        // turn right
        center_wheels();
        turn_left_ai();
        Task_Enable(1, 1);
        Task_Enable(2, 1);
        counter=0;
        state = 26;
        printState(26);
    }
}
/* From intersection #2/#3 to head towards short intersection */
if(state == 26){
    followline();
    counter++;

    if(intersection_type == 1 && counter > 60){
        // Disable Task 1, 2
        Task_Enable(1, 0);
        Task_Enable(2, 0);
        turn_right_ai();
        Task_Enable(1, 1);
        Task_Enable(2, 1);
        counter=0;
        state = 27;
        printState(27);
    }
}
/* Going towards #1 intersection */
if(state == 27){
    followline();
    counter++;

    if(intersection_type == 1 && counter > 60){
        // Disable Task 1, 2
        Task_Enable(1, 1);
        Task_Enable(2, 1);
        counter=0;
        state = 28;
        printState(28);
    }
}
/* Going towards #1 intersection */
if(state == 28){
    followline();
    counter++;

    if(intersection_type == 1 && counter > 60){
        // Disable Task 1, 2
        center_wheels();
        turn_right_ai();
        Task_Enable(1, 1);
        Task_Enable(2, 1);
        intersection_type = 0;
        counter=0;
        state = 29;
        printState(29);
    }
}
```

OUR PROJECT MANAGEMENT

- IMPLEMENTED A WEEKLY MEETING TO INVESTIGATE DEVELOPMENT IDEAS
 - START: 15
 - END: 2-3
- CREATED A WEBSITE TO KEEP TRACK OF ASSIGNED TASKS
 - UPDATED: 1 TIME
- RESOURCES
 - LACK OF MONETARY RESOURCES
 - LACK OF MOTIVATION FROM STUDENT INITIALLY INVOLVED
- DESIGN
 - NO COHERENT DIRECTION INITIALLY
 - FINAL DESIGN DEVELOPED 1.5 MONTHS BEFORE COMPETITION

DESIGN FLAWS

- DEVELOPED CODE ON DIFFERENT PLAYING FIELD AND LIGHTING CONDITIONS
- TESTED DESIGN ON UNDER DIFFERENT CONDITIONS THAN THOSE PRESENT IN COMPETITION
- OUTCOME: NOT-SO LAST PLACE

BETTER FOR THE EXPERIENCE?

□ I THINK SO...

- MAINTAIN MOTIVATION OF STUDENTS
- ACQUIRE NECESSARY RESOURCES PRIOR TO DESIGN PHASE OF PROJECT
- MAKE SURE TESTING UNDER PROPER CONDITIONS



QUESTIONS

