



Icarus



University of the
West of England

Micromouse

GROUP J:



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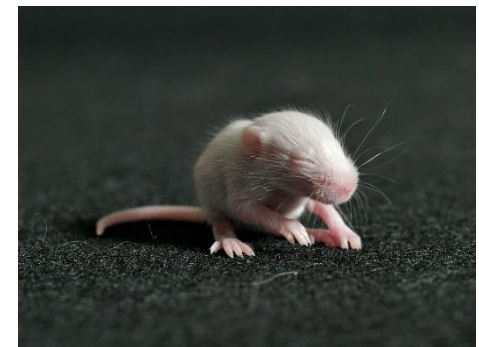
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Topics:

Introduction

- Project description

Review

- Gantt Chart review

Progress

- Achievements
- Difficulties

Reflection

- Learnings
- How to improve the group work for a next project?

Introduction: Project description

Design, build and test a mobile robot.

Micro-mouse competition.

- Maze 16 x 16

- Mice needs to

 - go to the centre

 - come back to start position

 - fastest route to the centre

Involves

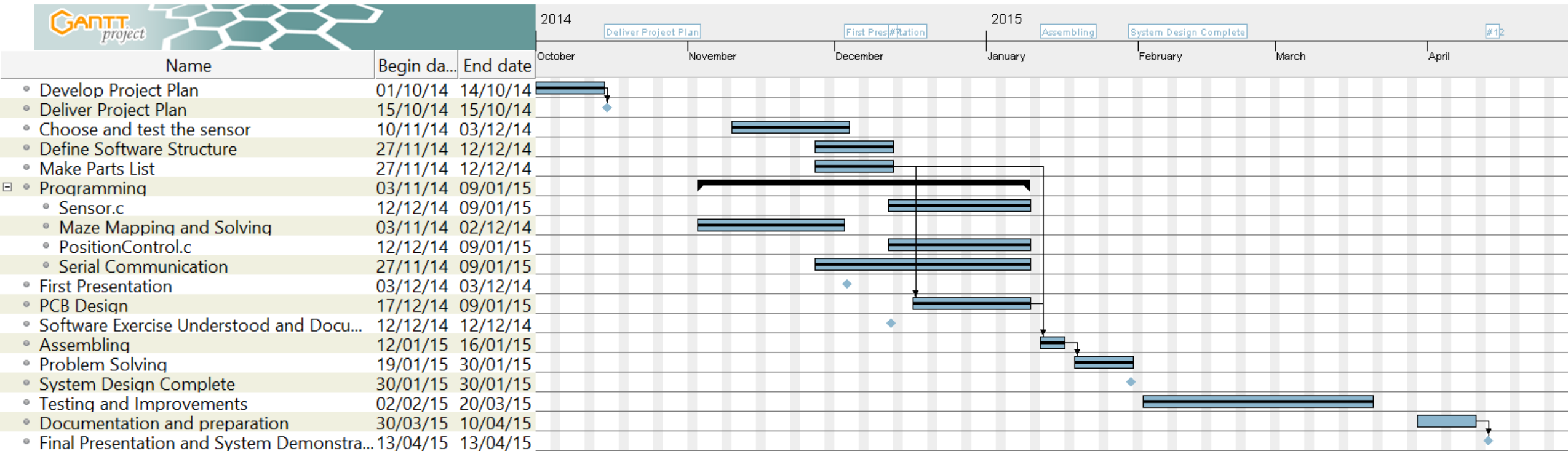
- programming embedded systems

- design electronic circuits and PCBs

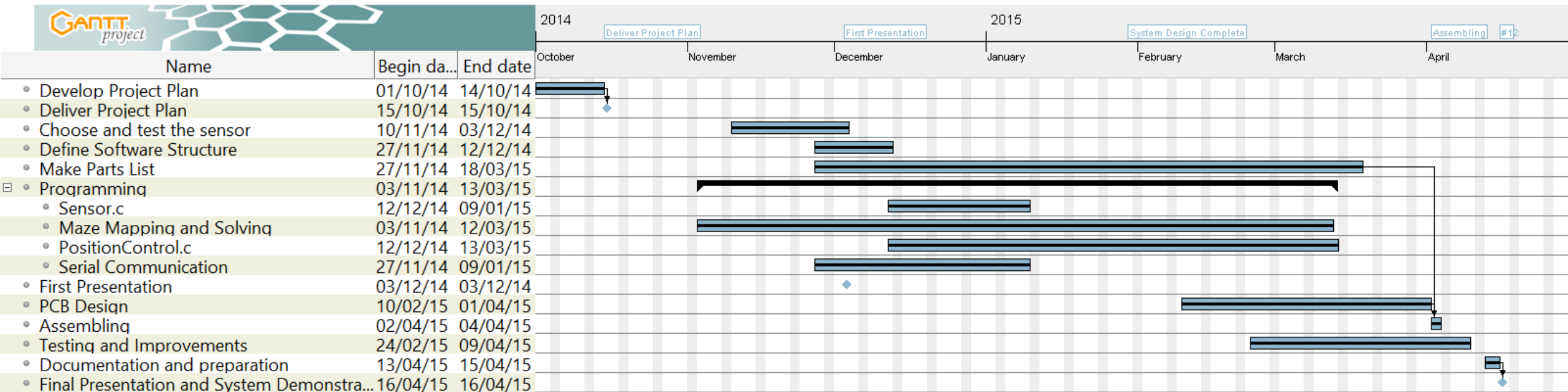
- implement mapping algorithms

Group work.

Review: Gantt Chart review



Review: Gantt Chart review



Progress: Maze Solving

Which algorithm to use?

- A* Search
- Using Stacks
- **Flood fill Algorithm**

How it works?

- Each cell contains a number which is the distance value to the goal.
- The values are recalculated after each movement of the robot.
- The next step is always the cell which contains the lowest distance value.

Operation modes

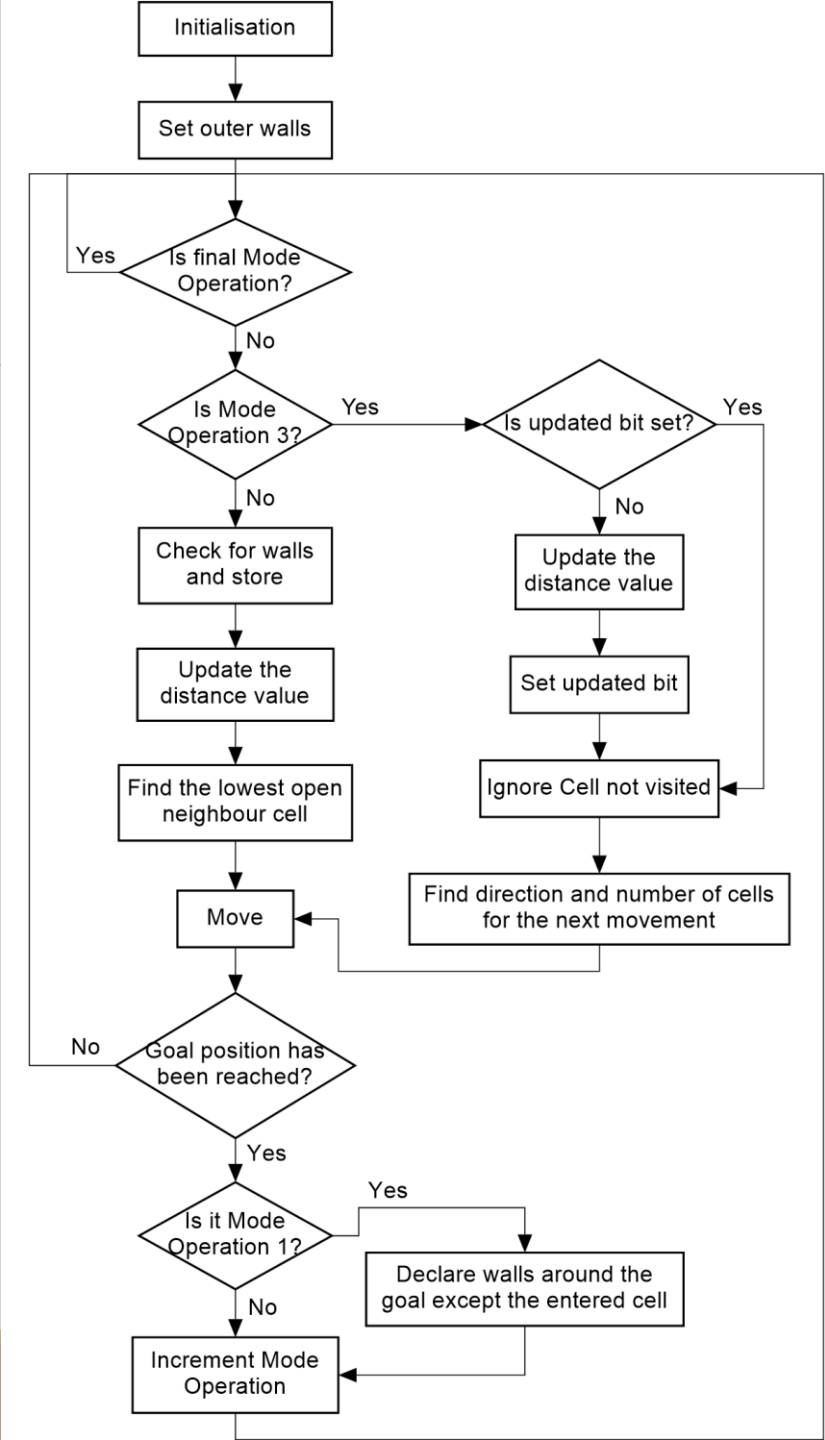
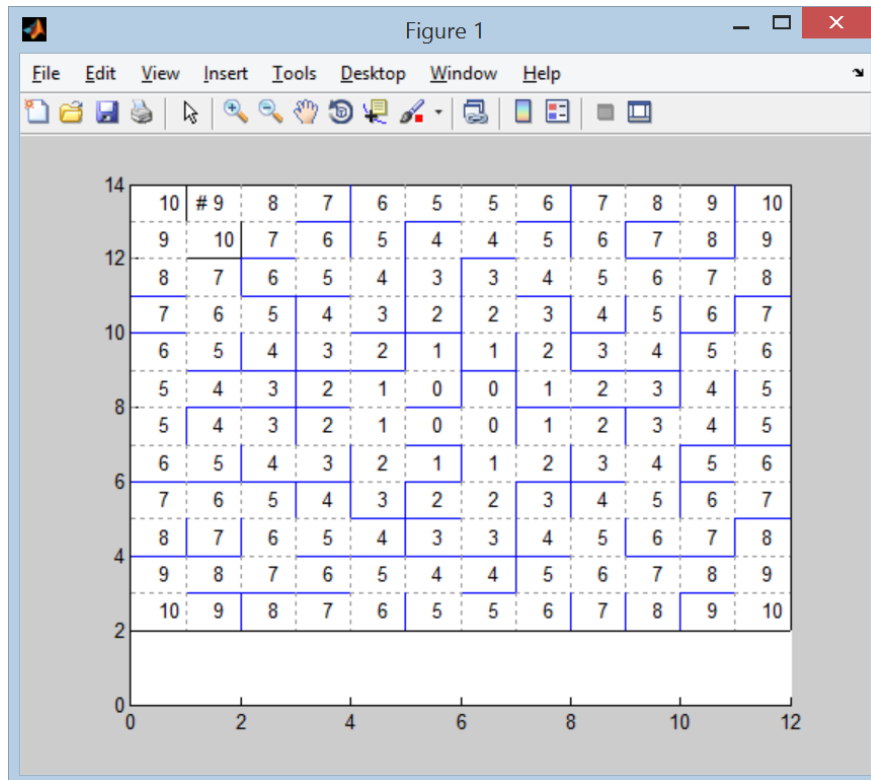
- 1 - Mapping the maze
- 2 - Going back to the starting position
- 3 - Going through the quickest path without searching
- 4 - Completed!

53	36	35	34	33	32	31	30	27	26	25	24	19	18	17	16
52	37	38	39	40	41	50	29	28	27	26	23	20	19	18	15
51	44	39	40	41	42	49	28	29	28	27	22	21	20	19	14
50	43	40	41	42	43	48	27	26	25	24	23	24	25	26	13
49	42	41	42	43	44	47	28	27	26	25	24	25	26	27	12
48	43	42	43	44	45	46	29	28	27	26	25	26	27	28	11
47	44	43	44	45	46	47	30	29	28	27	26	27	28	29	10
46	45	44	45	46	47	48	0	0	1	2	3	4	5	6	9
47	44	43	44	45	46	47	0	0	12	11	10	9	8	7	8
48	43	42	43	44	45	46	29	28	27	26	25	26	27	28	9
49	42	41	42	43	44	45	28	27	26	25	24	25	26	27	10
50	41	40	41	42	43	46	27	26	25	24	23	24	25	26	11
51	42	39	40	41	42	47	26	25	24	23	22	23	24	25	12
52	43	38	39	40	41	48	27	28	27	26	21	20	19	18	13
53	36	37	38	39	40	49	28	27	26	25	22	19	18	17	14
54	35	34	33	32	31	30	29	28	27	26	25	24	23	18	15

Progress: Maze Solving

How to simulate the algorithm?

- Using MATLAB.



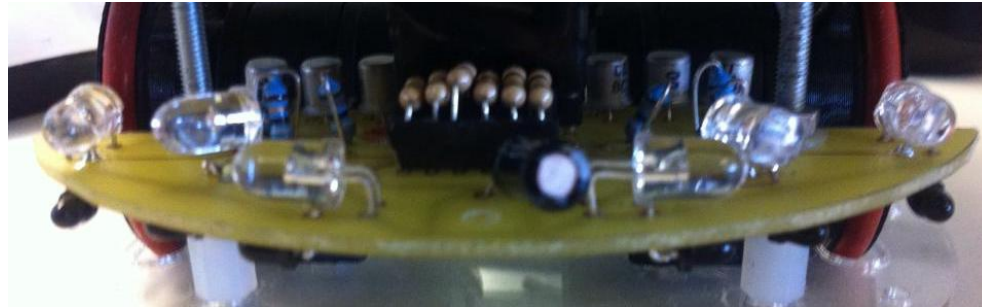
Progress: Sensors

Which sensors to use?

- Transmitter: viewing angle under 10 degrees.
- Receiver: viewing angles are always wider than emitter. Between 30-60 degrees.
- Source: http://micromouseusa.com/wp-content/uploads/2014/02/lecture-5-Parts_design_choicespart1.pptx

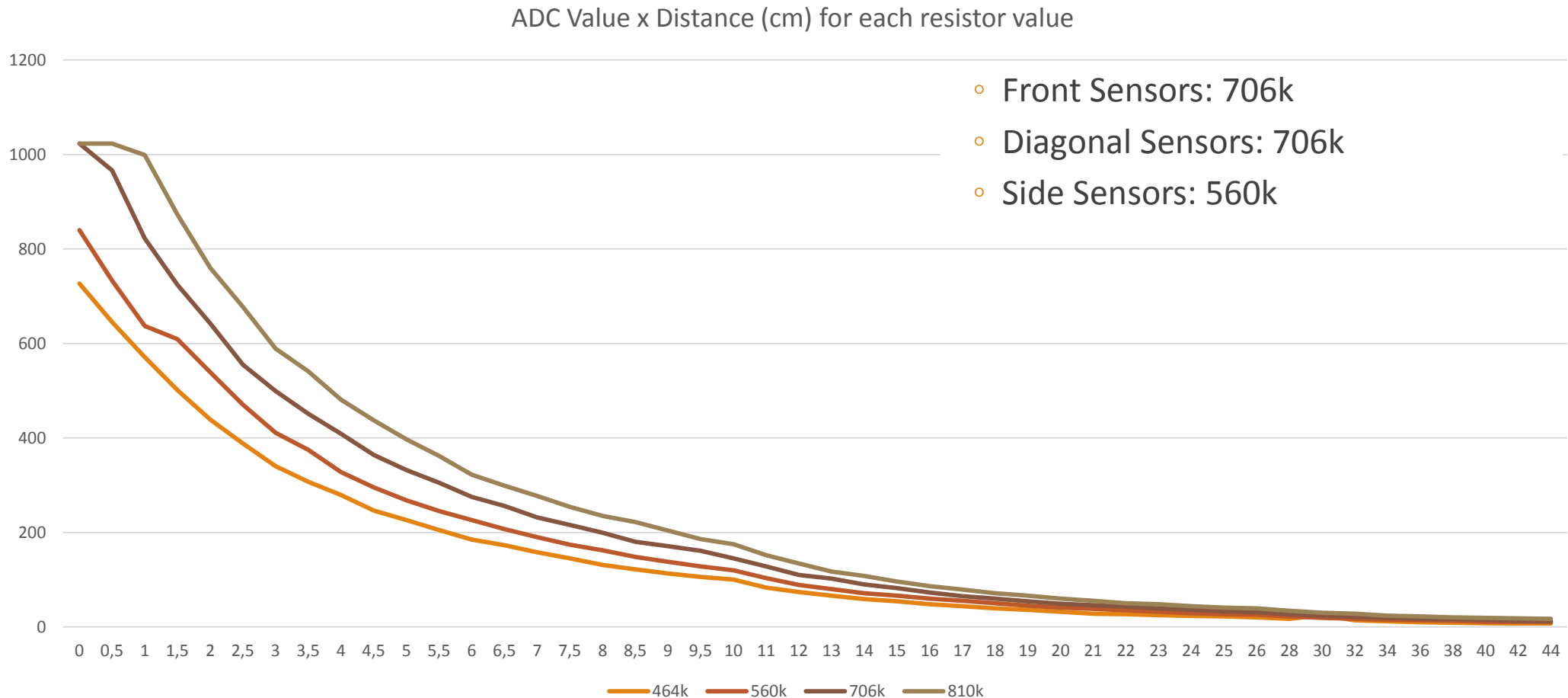
Where place the sensors?

- Two sensors
 - Looking forward.
 - Looking to each side.
 - Looking to each diagonal.



Which resistance values to use?

Progress: Sensors



Progress: Sensors

How to solve interference problems?

Switch each IR at a different time

- Make light compensation possible
- Avoid reflection between the sensors
- At the end light compensation was not necessary

Put tape on the board to prevent light from passing through it

Progress: Movements

How to determine that the mouse would have

- moved one cell?
- turned 90 degrees?

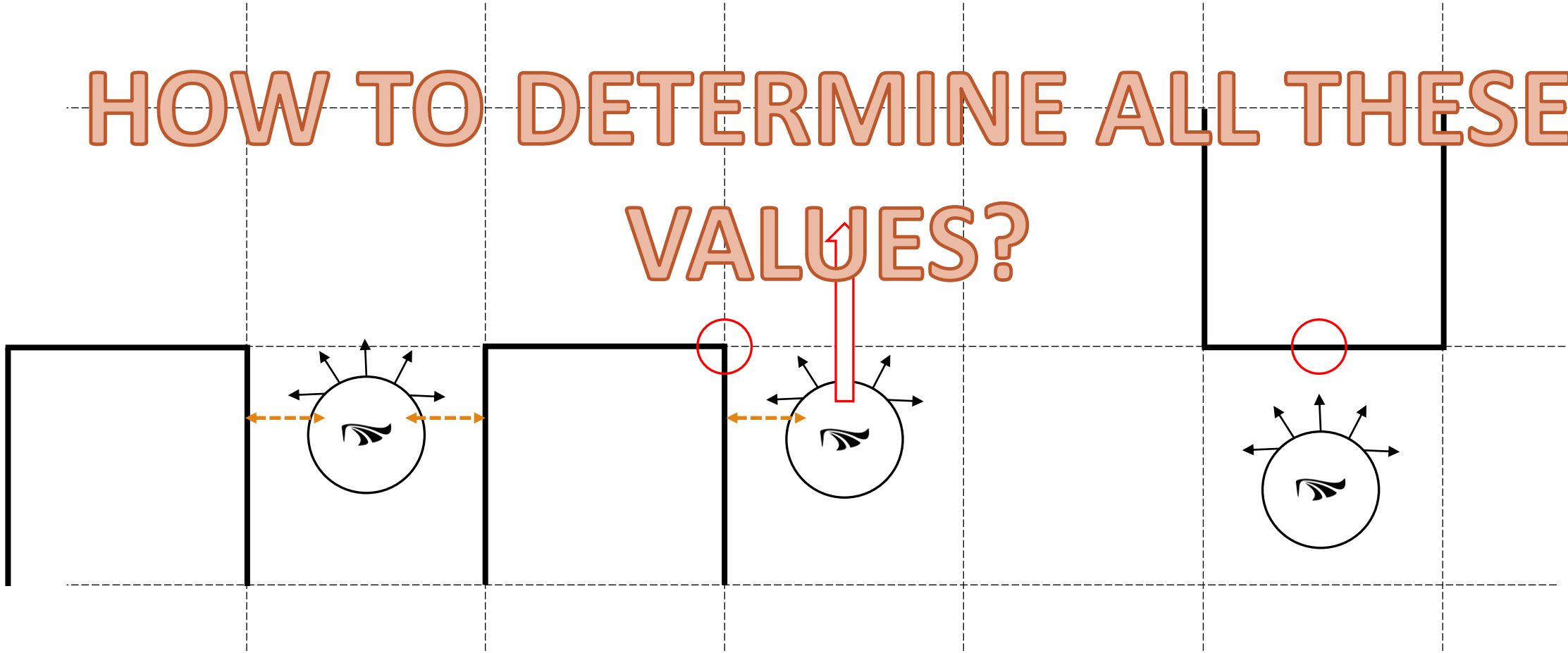
For each movement, count the number of encoder pulses needed

Can we trust this only? No!

Some additional method is needed!

Progress: Movements

HOW TO DETERMINE ALL THESE
VALUES?



Progress: Hardware

Bluetooth

- On-time connection
- Adjusting parameters
- Reading sensors/internal variables' values
- MATLAB was the interface used for such

Modular approach to PCB design

- Power supply
- Control Board
- Sensor Board
- Motor Board

Used both 4011 and 4012

- Less pins, same configuration
- Avoid oversizing and overpricing of the system

External frequency

- Increased from 8MHz to 10MHz (Internal fcy from 64MHz to 80MHz)

Use previously owned AA batteries



Progress: Hardware

“Unexpected item in the designing area”

Outer dimensions of some components were neglected

- Resulting in cutting connectors' edges

Sensor board supply couldn't go through the ribbon cable due to high current

- Exclusive supply was necessary

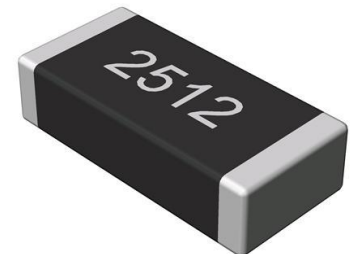
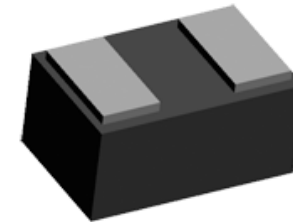
Sensor PCB prototype turned out to be the actual final board

Board for burning the PIC

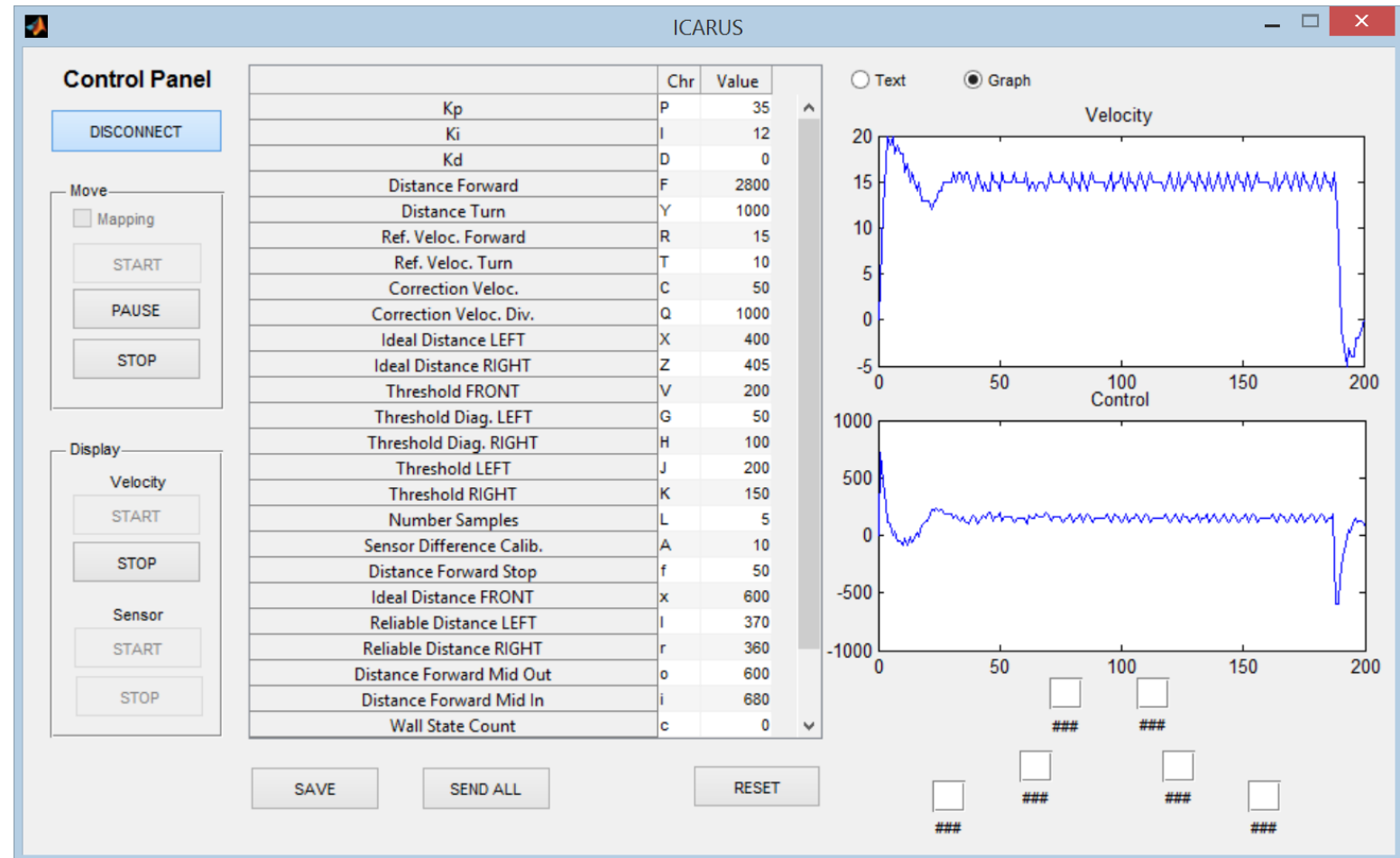
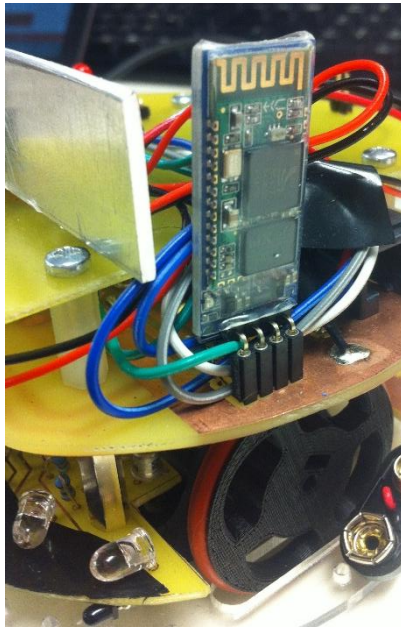
- RJ45 cable only works in one direction
- Left the PGD and PGC connections exclusive for the PIC Kit
- Used the alternative UART1 pins instead

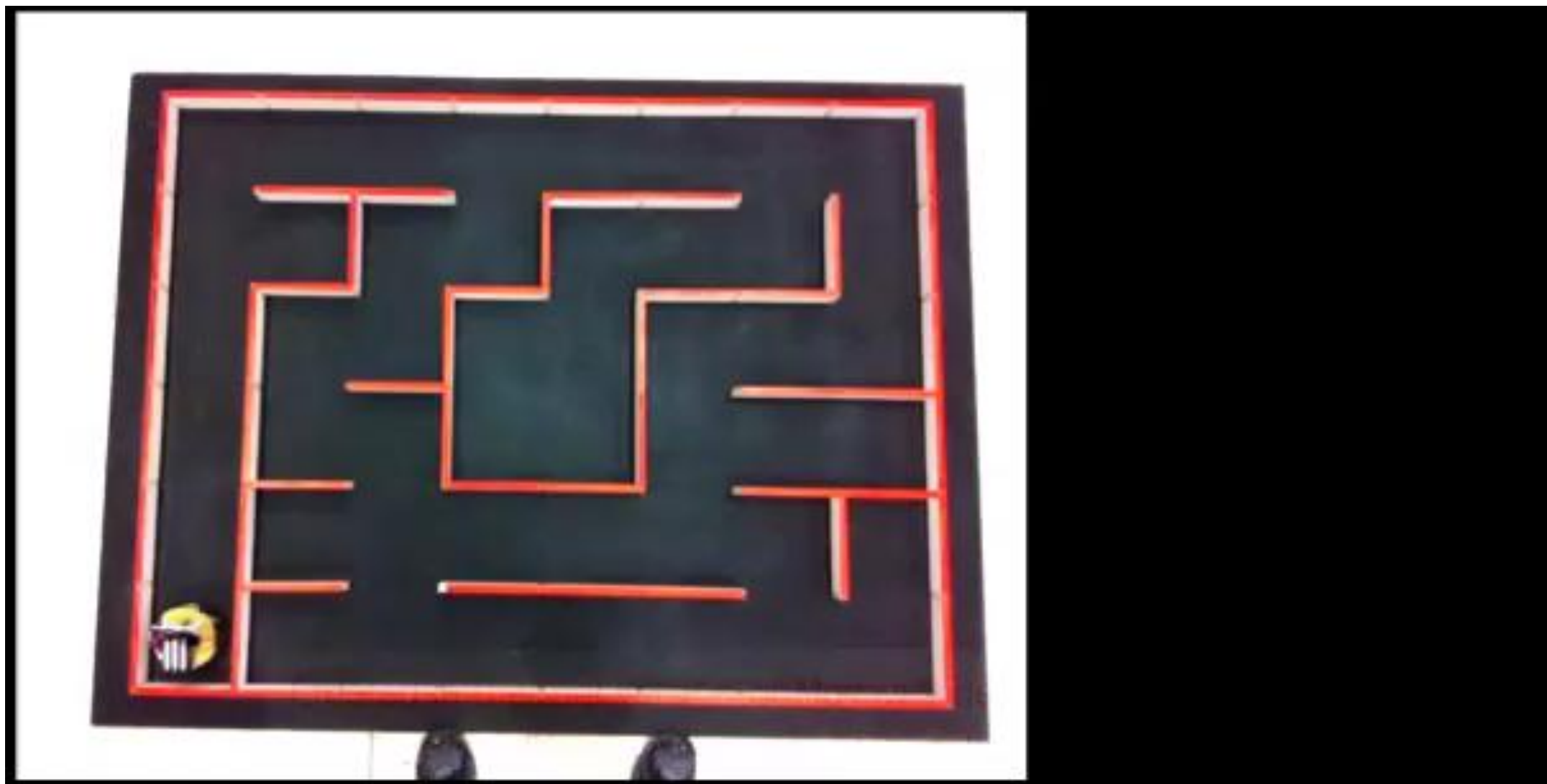
Took the challenge of using SMD components

- Solid state capacitor, 0603 resistors and diodes
- The diodes didn't have exposed side connections



Progress: Bluetooth





Reflection

- Assign tasks according to each member's interest and knowledge;
- Having regular meetings to update group progress;
- Set deadlines and presentations for individual tasks;
- Integration for the members of the group.

Thank you!
And... Enjoy the summer!

