13/12/2011

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Office Automated Delivery Robot

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Outline

- Introduction
- Hardware
- Software
- Business Aspects
- Future Developments
- Conclusion
- Review
- Questions
- Acknowledgements

Introduction - Our Team

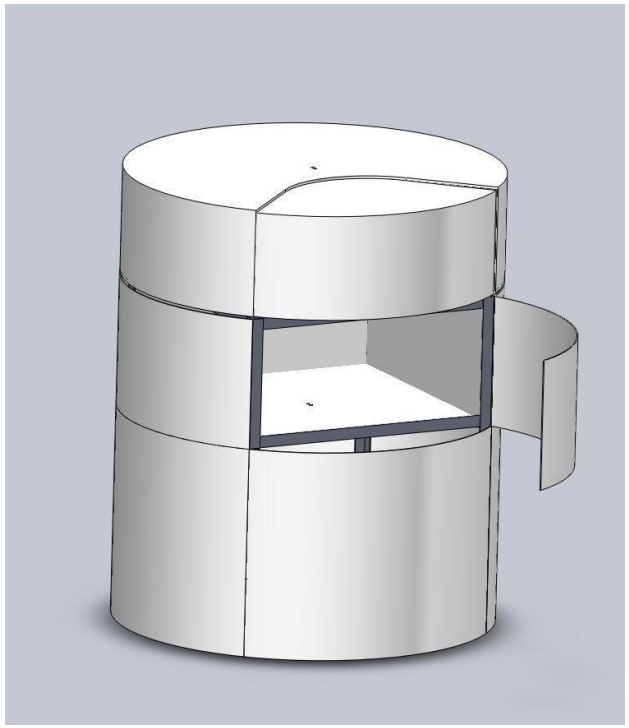
- CEO - Gyu Han David Choi
- CTO - Jin Sun Ahn
- CFO - Hongbae Sam Park
- CMO - Kyu Seo Sam Lee
- COO - Yongho Choi

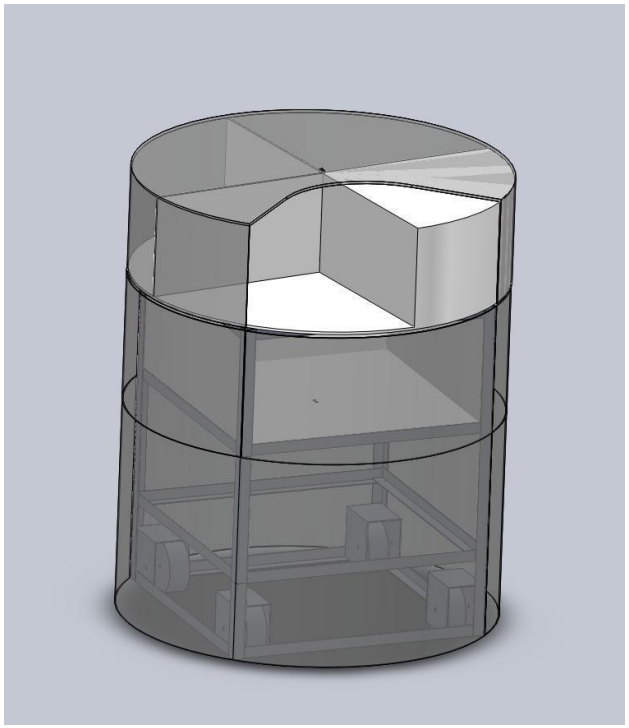
Introduction – Objective

- To increase efficiency within office space.
- To save time thus cutting expenditures
- To aid in removing avoidable tasks such as delivering documents from department to department.
- Employees can focus on their tasks without leaving their stations.
- As a public secretary who can “run errands” for every worker.

Introduction – Initial Goal

- Conceptual Diagram





Introduction – Actual Prototype

- Actual Picture

Hardware

by

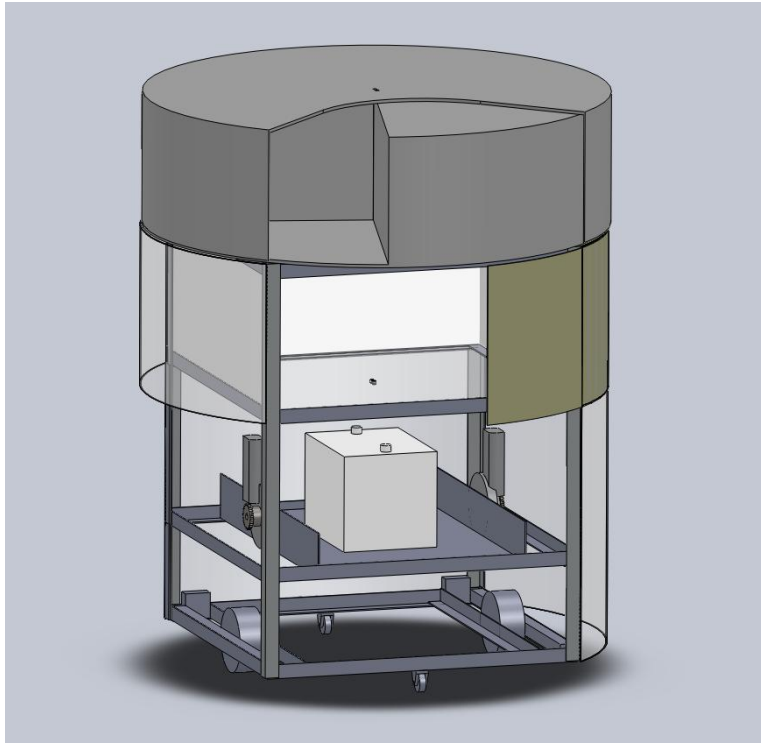
Sam Park

Hardware Outline

- Chassis
- Drivetrain
- Lockable Door
- Proximity Sensor
- Microcontroller
- Power Supply
- Camera
- System Block Diagram

Hardware – Chassis

- Conceptual Picture



Hardware – Drive-train

- Motors (AME-214)
  - Automotive Windshield Wiper Motor
- Wheels
  - 4” heavy duty rubber wheels with ½” bearings, and 19-teeth sprocket
- Wheel Mounts
  - Custom made composite wood structure which can accommodate ½” axles
- Gears
  - 19 teeth sprocket linking wheels and Motors
- Chains

Hardware – Lockable Door

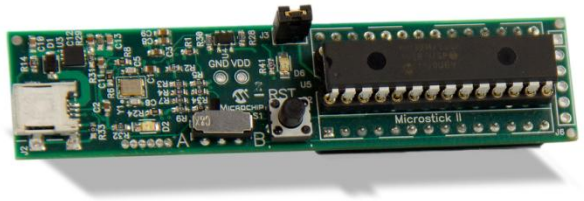
- Opens after arrival at the destination
- Locks during operation for safety and security

Hardware – Proximity Sensor

- LV-MaxSonar – EZ1: MB1010
- Collision detection

Hardware – Microcontroller

- MICROCHIP dsPIC33FJ64MC802
- Serves as a drive motor controller, processes collision detection, communicates with database, also controls compartment door actuation motor



Microchip Microstick 2
(Part # DM330013-2)

Hardware – Power Supply

- 12 V Sealed Lead Acid Rechargeable Battery

Hardware – Camera

- Microsoft LifeCam HD-3000
- QR code scanning

Hardware – System Block Diagram

- Actual Picture

Software

by

Sam Lee

Jin Sun Ahn

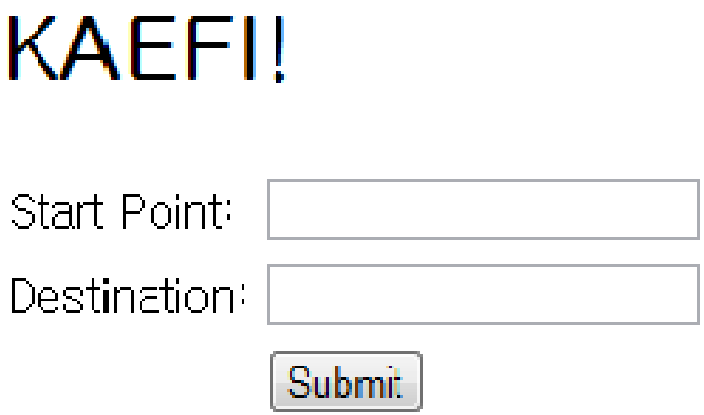
Yongho Choi

Software Outline

- User Interface
- Database
- QR Code Scanner
- Routing Algorithm
- Motor controller
- UART
- System Flow Chart

Software – User Interface

- Website UI



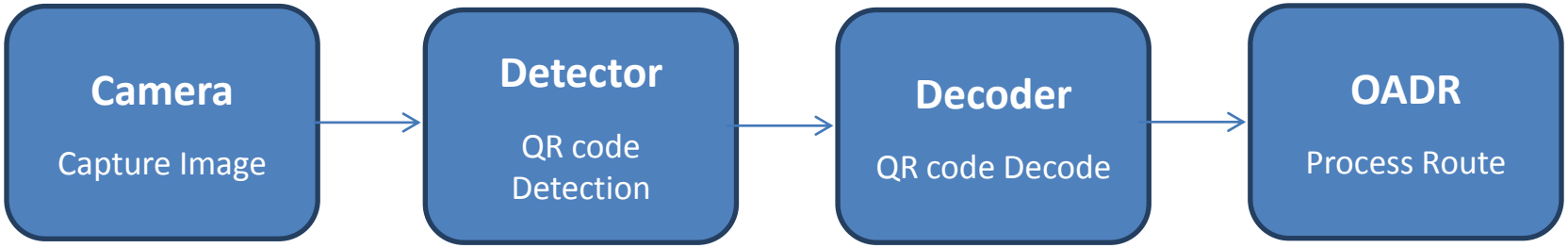
Software – Database

- Database structure
- Table Name : KAFEI_INFO

Column Name	Column Explanation
ORDER_NUM	Order sequence
ROBO_ARV	Starting station
ROBO_DES	Destination station
ROBO_STRT_DT	Order timestamp

Software – QR Code Scanner

- QR Detecting + Decoding Process



Software – QR Code Scanner

- QR Orientation Determination

0°

90°

180°

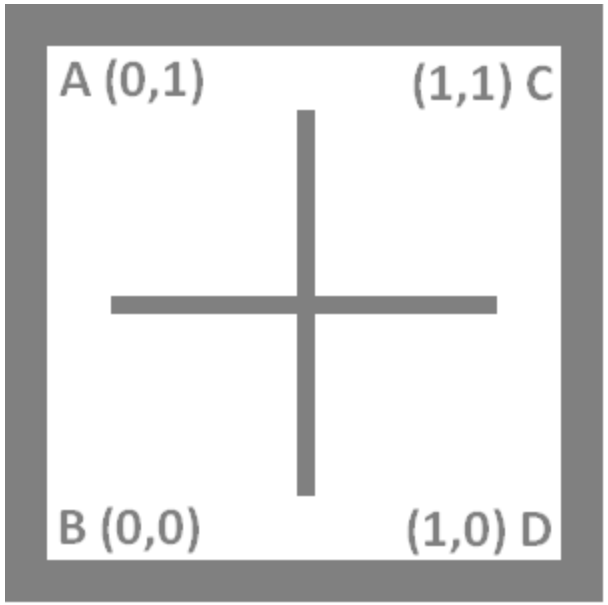
270°

Software – Routing Algorithm

- Notation : (x,y)
- Destination Point -Starting Point
- i.e A -> B

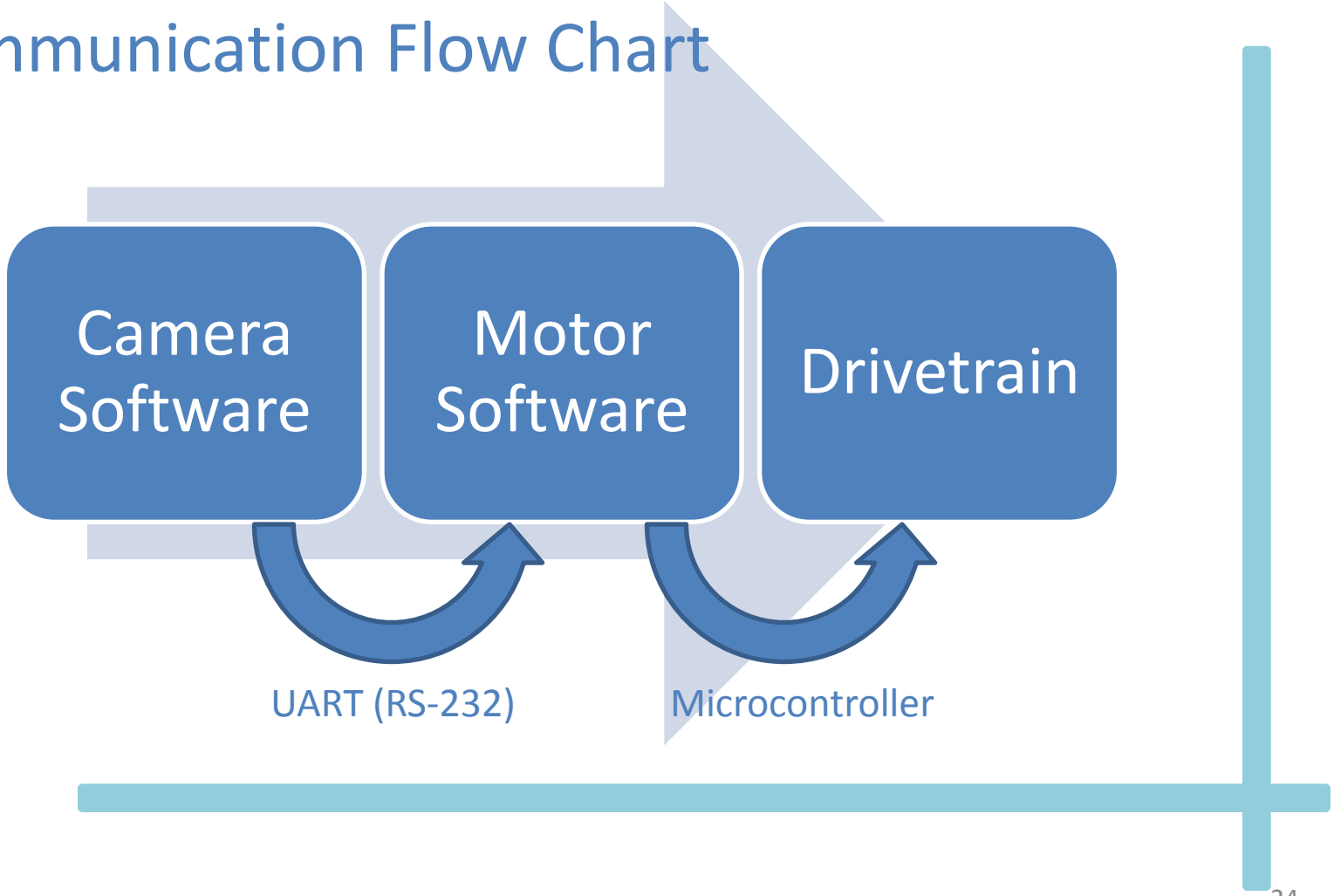
  <0,1> -<0,0> = <0,-1>

  Move down to 1



Hardware + Software

- Communication Flow Chart



Software – UART

- Sparkfun FTDI Breakout 5V DEV-09115
- Communication between camera software and microcontroller
- USB (PC) to RS232 (MC)

Software – Port Setup

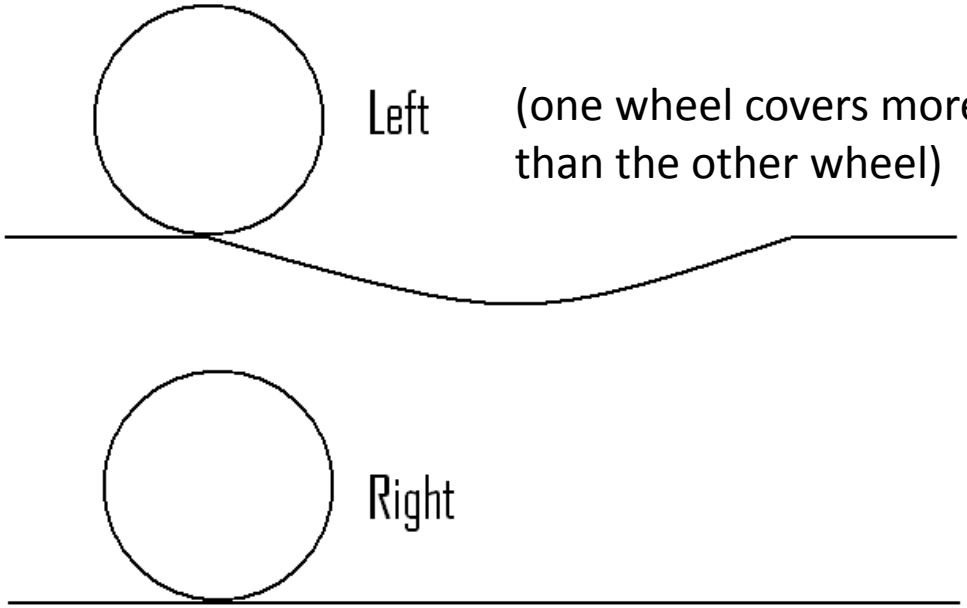
- PC (C++): “Boost” open source library to setup the serial port, send data to microcontroller using USB to RS232 breakout
- Ex) write(port, buffer(char[0], 1));
- MC (MPLAB): Register and port setup needed in order to receive the data
- Ex) RPINR18bits.U1RXr = 10; //U1RX pin setup
- U1MODEbits.UARTEN = 1; //Turn on UARTs

Software – Motor Controller

- Based on route vector and orientation given by QR Code Scanner
- Motor Control Command
  - Go : Proceed operation
  - Right : Take a right turn
  - Left : Take a left turn
  - Spin : Take 180 ° turn
  - Halt : Stop all operation

Software – Motor Controller

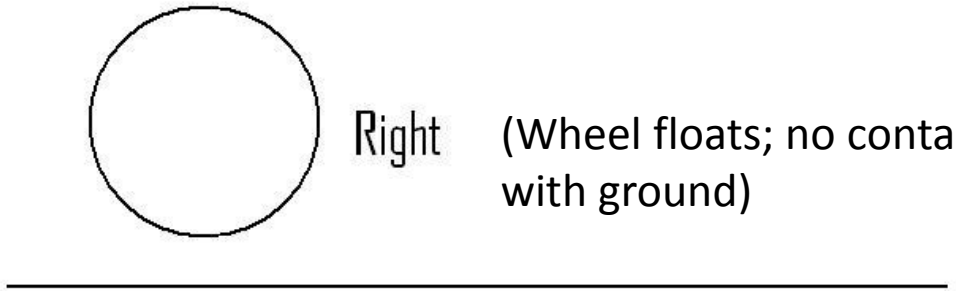
Situations where robot cannot go straight: Case 1



(one wheel covers more distance than the other wheel)

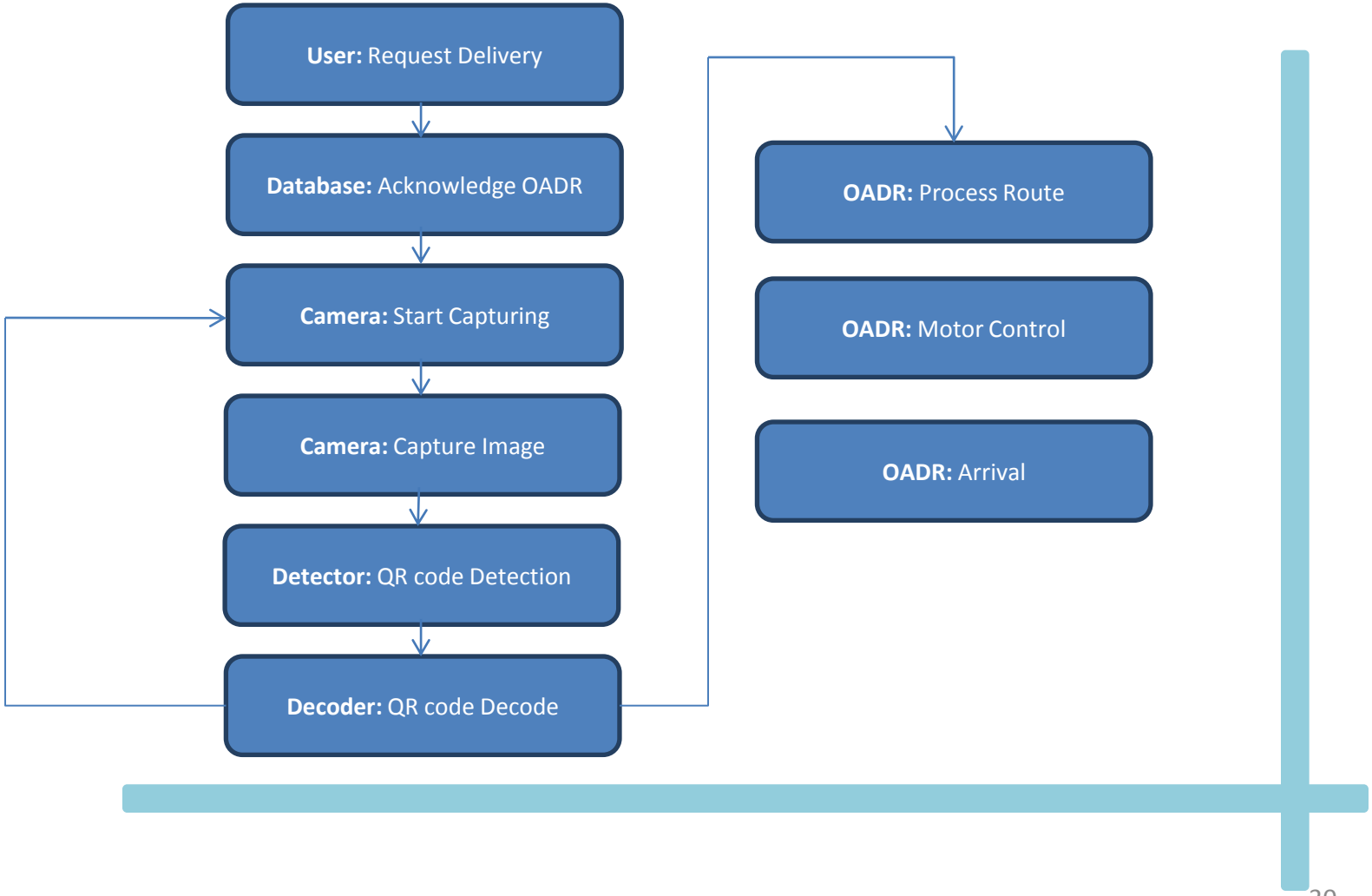
Software – Motor Controller

Situations where robot cannot go straight: Case 2



(Wheel floats; no contact with ground)

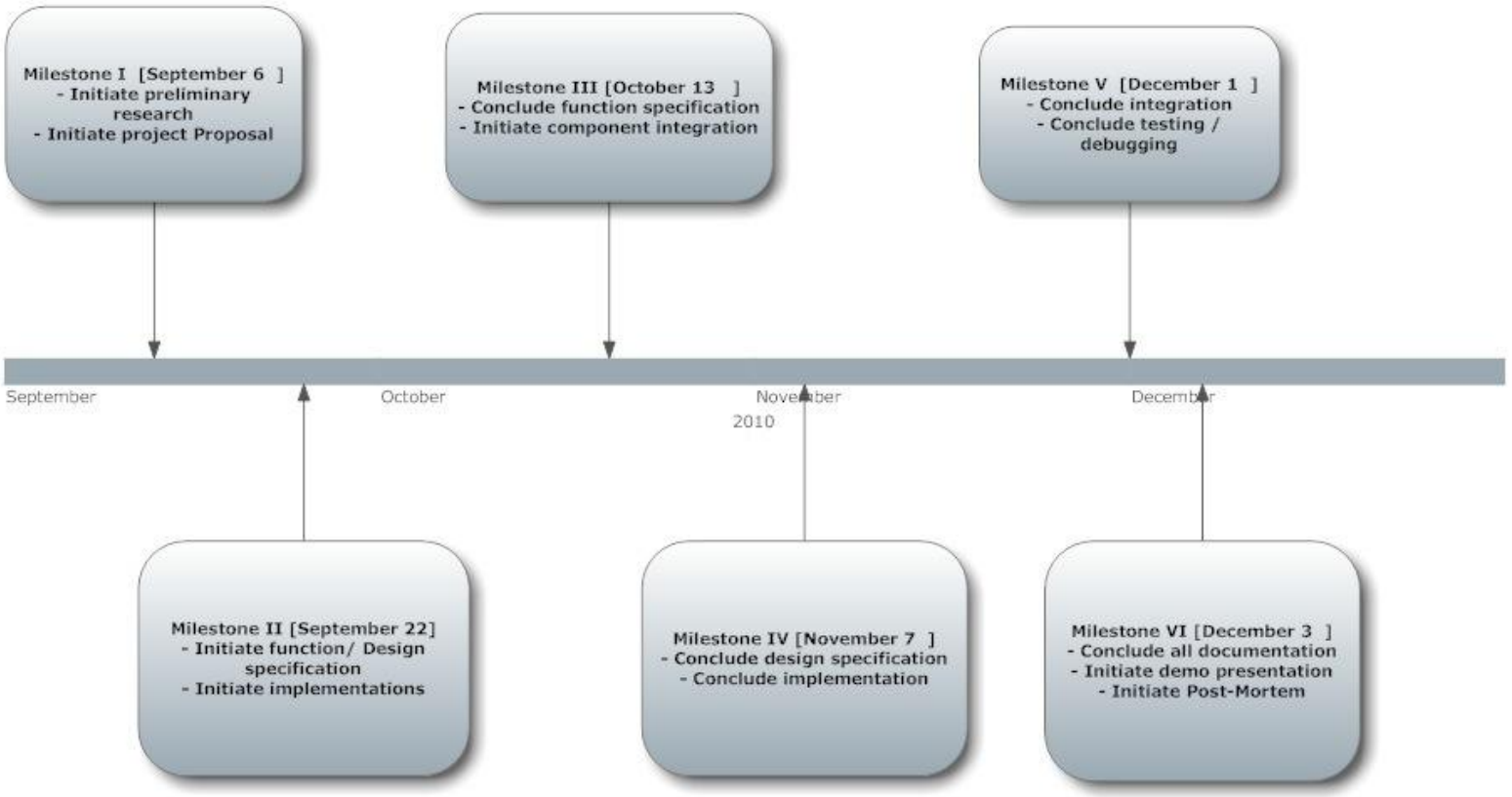
Software – System Flow Chart



Business Aspect

- Milestone
- Timeline
- Actual Cost

Business Aspect – Milestone



Business Aspect – Timeline

Blue Line: Proposed Timeline

Red Line: Actual Timeline

Business Aspect – Actual Cost

Equipment List1	Cost
Webcam : Microsoft LifeCam HD-3000	$55
Microcontroller : MICROCHIP dsPIC33FJ64MC802	$25
Proximity Sensor : LV-MaxSonar – EZ1: MB1010	$30
Banebots FIRST CIM 12V 5280RPM Brushed DC Motor x 2	$50
Wheels x 2	$88
Motors	$70
Aluminum Frame	$120
12 V Sealed Lead Acid Rechargeable Battery	$45
UART Sparkfun FTDI Breakout 5V DEV-09115	$25
Misc. (including bolts, nuts, L-fame bridge, adapter)	$150
Cosmetics	$30
Total Cost	**$588**

Future Development

- UI system on the robot
- Sensor inside Lockable door
- Password Keypad for manual disclose
- Rotating Compartment
- Extra items storage/delivery
  - (i.e. coffee, beverages)

Conclusion

- Is adoptable anywhere
- Easy to use
- Can deliver various items
- Meet safety requirements
- Can be applicable variously

Acknowledgements

- Thanks to
  - Andrew Rawicz
  - Shahram Payandeh
  - Gary Houghton
  - Patrick Cho

Review

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- Software
- Timeline
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Questions ?

Demonstration