Embedded System Project
CS- 684
Spring 2018

Self Orienting Smart Chair

Under the guidance of Prof. Kavi Arya and Mr. Lohit

Group Members

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1st Demo

Problem Statement

- Marker based navigation of the chair in a clear and obstacle-filled environment.

- Ensure that the system performs well, and is therefore suitable for easy handling of messed up chair orientation.

Frames from web camera

Pan web camera

Data processing into Firebird robot

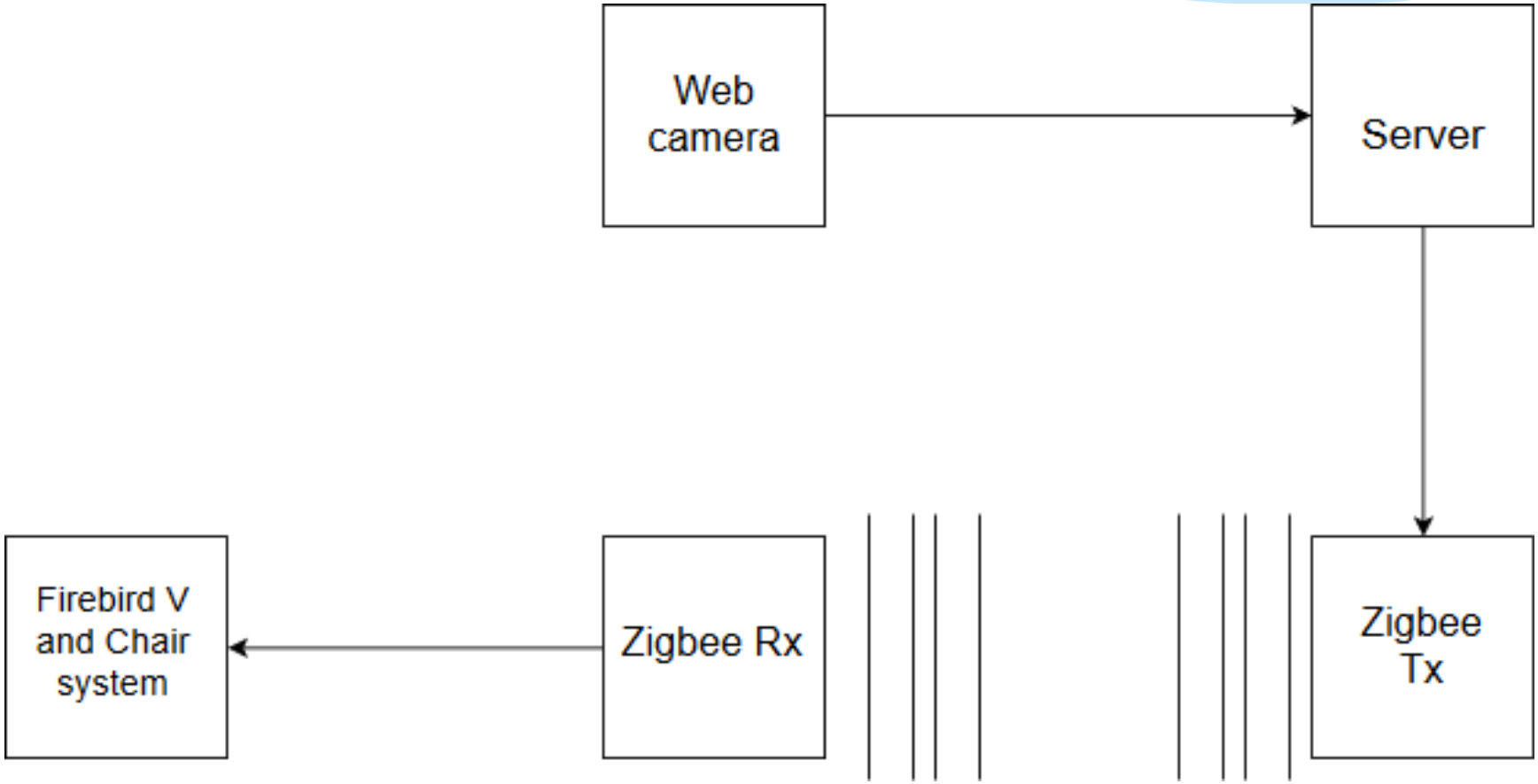
Main loop
- Receive frames from camera
- Detection of ArUco Marker
- Pan Webcam
- Set flag for chair localization
- Data processing into the server PC

Set flag for chair localization

Chair_localization thread
- Checks flag value
- Issues command to Chair

Sends move movement to chair through zigbee

Abstract Block Diagram



Requirements

Hardware

- Chair (Plastic Stool)
- Mechanical System (Spring Actuated)
- Firebird (with omnidirectional wheels)
- ArUco Marker
- Camera
- Zigbee module

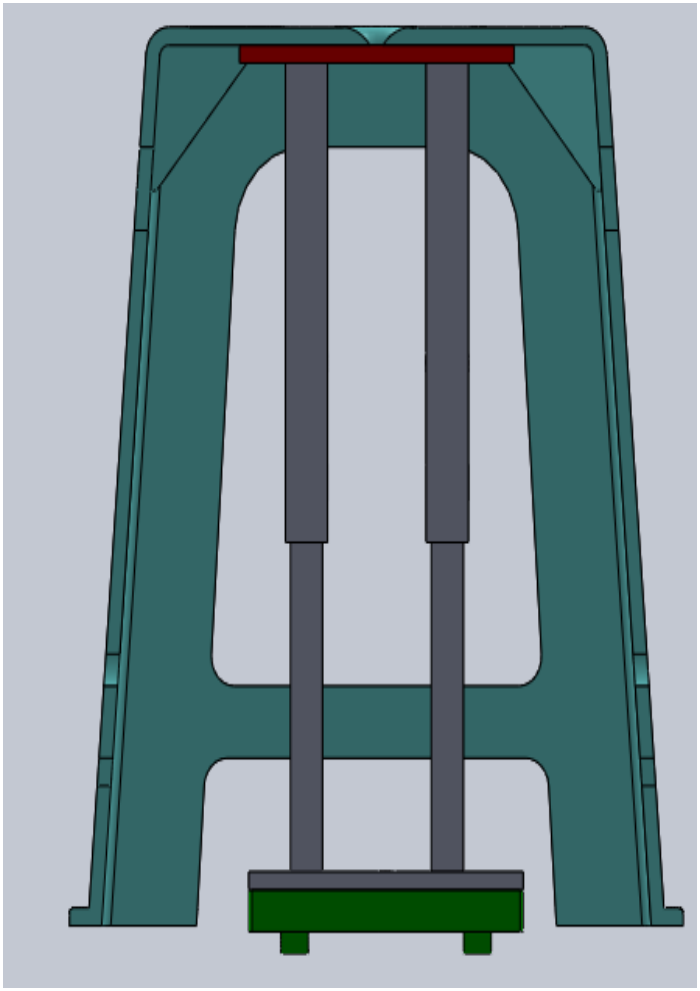
Software

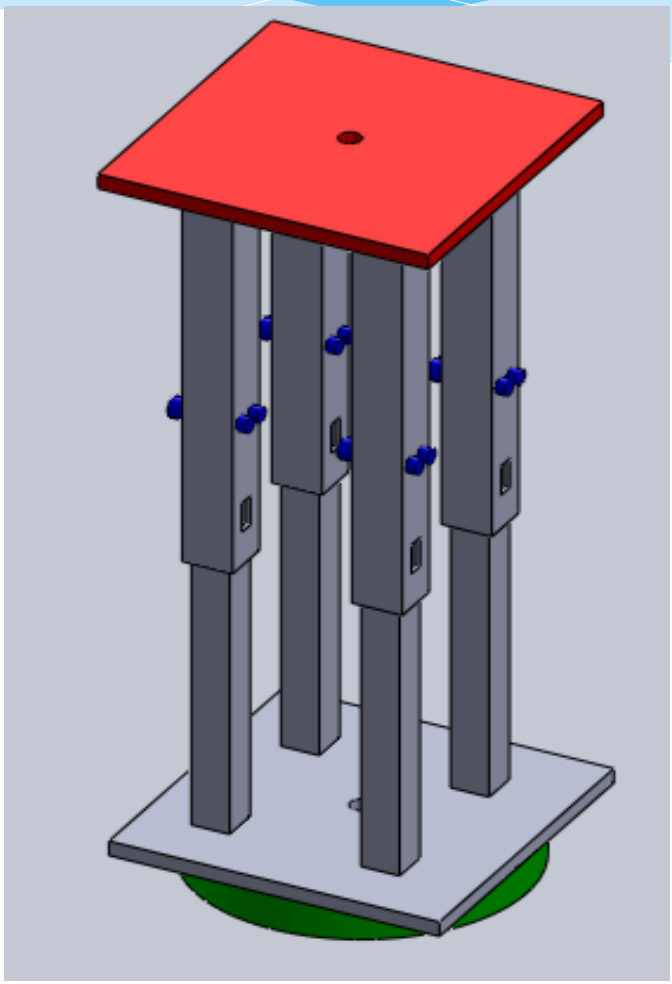
- C, C++, Python
- Firebird libraries, ArUco libraries
- Open Cv

Challenges

- Marker detection using ArUco
- Set up communication between firebird robot and server computer
- Path Calculation for navigation
- Accurate mapping of real movement of chair
- Power constraints
- Designing of mechanical set-up to establish on existing chairs.

Mechanical Design





Deliverables

- Mechanism for the localization of chair from its disoriented location.
- Algorithm for navigation as well its orientation
- Smart solution for the chair to better communication between speaker and the audience

Test Strategy

Timeline

Date	Task to be completed
21st March	Familiarizing with Firebird platform and ArUco
28th March	Marker detection using webcam and Firebird, study of path calculation for navigation
4th April	Procurement and Building of prototype
11th April	Testing Phase

2nd Demo

(05-04-2018)

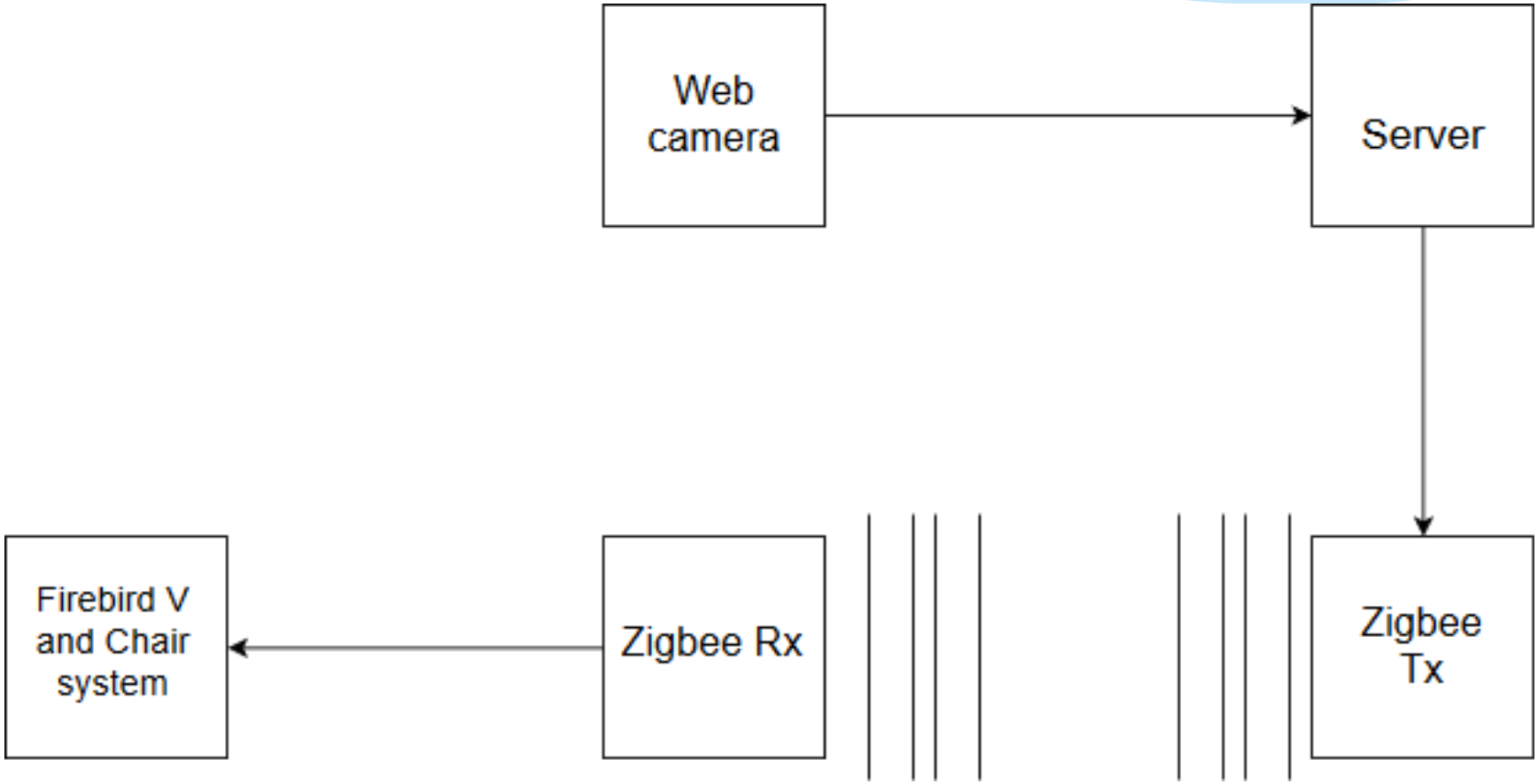
Work done till date

- **ArUco code generation**
- **Detection of ArUco using webcam**
- **Fetching co-ordinates for present location of the Firebird**
- **Wireless transmission of fetched co-ordinates using Zigbee for further navigation of the Firebird.**

3rd Demo

(16-04-2018)

Abstract Block Diagram



SUBSYSTEMS

FIR

ArUco KER detection and decision making

COMMUNICATION

FIREBIRD-V NAVIGATION

- Rotatory encoders / Position encoders
- Motor control
- UART Xbee receiver

ArUco GENERATION & DETECTION AND DICISION MAKING

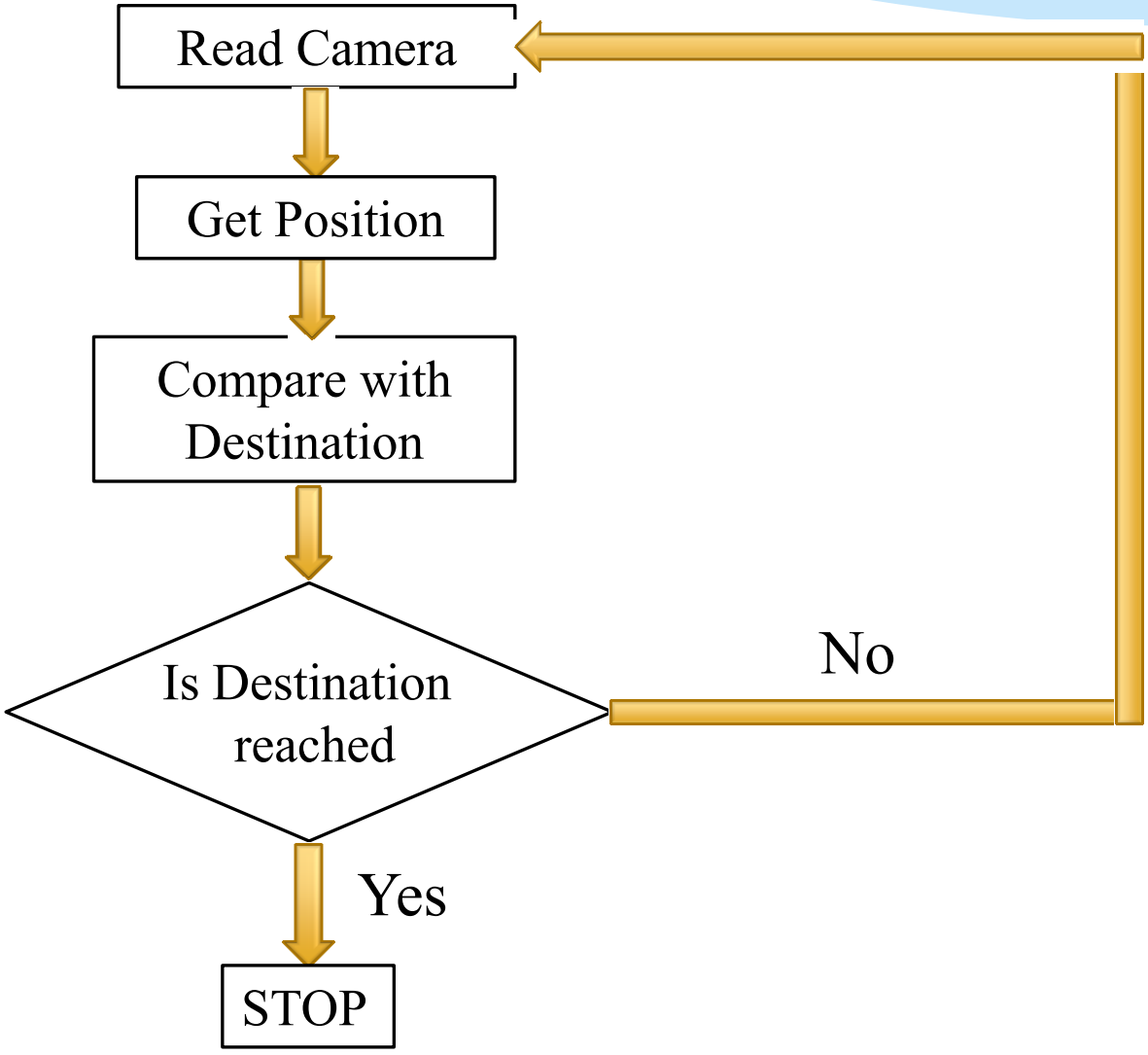
- Generation of 5x5 ArUco marker
- Detection of multiple markers
- Sending results to robot via USB PORT connected to Xbee

COMMUNICATION

- Configuration of Xbee coordinates and end device

- Sending up PAN IDs & device address

SERVER SIDE ALGORITHM



MESSAGE PASSING & INTERPRETATION AT FIREBIRD

MESSAGE	ACTION
A	Rotate Right by 5^o
R	Turn 90^o Right
L	Turn 90^o Left
F	Move forward 10mm

Expected Output:

Firebird robot initially placed in any orientation to rotate and align to reference and navigate to destination

Output :
It reaches close to predefined destination with some errors

Acknowledgments

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