Assignment 1	Project Summary
Course	Practical Robotics and Smart Things - 2020

Project author		
№	Pseudonym	In person/online
1	4e 54	face-to-face

Project name	Cine-Bot α (CB-A1) ()

1. Short project description (Business needs and system features)

Cine-Bot α (CB-A1 for short) is a small camera controlling robot intended to be used for scale stop-motion animation/movie making. CB-A1 aims to utilize the newest technologies in the IoT & robotics world.

CB-A1 is comprised of 2 parts, the robotic cine arm (RCA) and motion capture controller (MCC). Although the RCA itself will have a screen, the MCC is used to interface with the RCA remotely via a wireless connection. Via the MCC the operator can control every aspect of the RCA from the camera to motion programming. In the following section both components are discussed in more detail.

The hardware implementation as mentioned before is divided into two parts:

1. The RCA
2. The MCC

The RCA

The RCA is based on the Raspberry PI 4 4GB.

Sensors:

- Accelerometer – used for camera and arm control.
- Gyroscope – Used for camera tilt/rotate movement.
- Ultrasonic distance sensors – used for 360 collision detection during full manual mode (mode described later in the “Modes” section.

- Light sensor – used for operator feedback & automatic lighting adjustment.

Image/Video capture & lighting:
- Raspberry Pi Camera v2 – uses as primary image/video capture device.
- LED Array for scene lighting – used as a backup light source for the camera
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User controls:
- LCD Touch screen - for user interaction
- Buttons - for motor jogging mode (testing motors directly from the robot)
- On/Off button

Actuators:
- *Servo/stepper motors – used as primary control devices.*

The MCC

The MCC is also based on the Raspberry PI 4 4GB.

Sensors:
- Accelerometer – used to capture user motion in the X, Y, Z axes.
- Gyroscope – used to capture user rotation motion (tilt/pan)

User controls:
- LCD Touch screen - for user interaction
- On/Off button
- Servo for collision warning system – provides feedback to the user weather or not the RCA is about to hit an object.

Modes of operation

1. Full manual – control comes directly from MCC.
2. Manual Stabilized – control comes from the MCC but is filtered to remove shaking from the operator.
3. Learn & repeat – control comes from MCC once and then the path is remembered and can be executed again.
4. Tracking semi-auto – can lock onto object but is controlled by MCC.

5. Tracking auto – tracks object without ability for MCC control.
6. FrameX (auto after initial programming) – stop-motion mode. Follows path divided into frames, ideal for making a stop-motion sequence.

User interaction

The main way the user will interact with the system is either through the GUI directly on the RCA or through the MCC GUI.

Communication Between Modules

(Currently being researched but it will likely be via UDP or Ad-hoc Wi-Fi

2. Main Use Cases / Scenarios		
Use case name	**Brief Descriptions**	**Actors Involved**
2.1. Select Mode	The *User* can browse the different modes that are available and select one.	All users
2.2. Start Execution	*The user can start the execution if the full auto mode is enabled*	*All users*
2.3. Jog Mode	*The user can test if all of the motors are functional by pressing the buttons on the machine.*	*All users*
2.4. Full Manual Mode	*The user controls all of the parts of the robot arm.*	*All users*
2.5. Manual Stabilized Mode	*The user controls all of the parts of the robot, but there is motion stabilization to remove tremors. (May not be included in final version)*	*All users*
2.6. Learn and Repeat Mode	*The user executes a path, the robot learns it and then repeats it.*	*All users*
2.7. Tracking semi-auto Mode	*Tracks an object while being controlled by the user. (May not be included in the final version.)*	*All users*

2.8. Tracking Auto	*Tracks an object on the scene.*	*All users*
2.9. FrameX	*The users sets a path with waypoints the robots executes it while taking picture every n seconds.*	*All users*

3. Renders/Project Visualizations (In development)