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**--TITLE--**

**TABLE OF CONTENTS**

***Identify group members ……First week group meeting***

***Determine team members' distribution of labour ……Second week group meeting***

***First week’s progress reports and system integration ……Third week group meeting***

*Develop the rover's system. Team members work on their partially constructed modules and discuss coordination and communication difficulties.*

***Improve some group's modules ……Third week day-to-day progress***

*Mainly on adjusting the communication content of each module and the robot arm, improving the OpenMv pathfinding system and writing initial report.*

***Second week’s progress reports and system integration …Fourth week group meeting***

*Submit third-week progress, and discuss methods to integrate the system and finish later modules.*

***Improve some group's modules ……Fourth week day-to-day progress***

***Third week progress reports and midterm assessments ……Fifth week group meeting***

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**First week group meeting**

*Date:*Thursday, 23 February 2023, 19: 00 PM-20: 00 PM

*Purpose:* Identify group members

*Procedures:*

1. During the first week of class, I sat in the Liren Building classroom and listened intently as the teacher outlined the guidelines for this group assignment.

2. Classmates and I spent an hour after class debating and adjusting the team members in each major( including IE, ME and CE) to form a fair and cohesive team.

*Results:*We set our ten members from three majors: four IE majors, four CE majors, and two ME majors.

*Conclusion and suggestions for future experiments:*After confirming the division of labor，our team members and I should read the tasks and requirements of the project for this semester carefully and confirm the division of labor among members during the next week.

*Recorded by:* Gu Xingci

**Second week group meeting**

*Date:*Tuesday, 28 February 2023, 16: 15 PM-18: 00 PM

*Purpose:* Determine team members' distribution of labour

*Procedures:*

1. Firstly, our team members and I clarified the project's goals and timeline. Our aim was to programme a robot to carry out a series of operations and complete two patios’ activities, each with three tasks.

2. We started with both patio1's and patio2’s tasks, deciding that our team needed to confirm the construction of our rover model system before moving on to the pathfinding process of the initial goal. At this point, everyone started introducing the parts they are good at, for example, Chen Xi said he is suitable for the control module based on the servo principle; Yang Chun said he is suitable for handling the openmv vision processing module; and Yuan Ye said he is good at building the system's framing.

3. After that, we confirmed the initial roles assigned to each member of the group, Sun Linhan, Guo Linhong, and Zou Hanlin were all working on PCB and document integration. In this group, I was in charge of writing notebook and initial report. Chassis and tyres were Sheng Dian's domain. Motor maintenance is within the purview of Chen Xi. Li Chenghao and Liu Cehan was in charge of the communication between modules and adjust clock frequency. The OpenMv module was developed by Yuan Ye, and Yang Chun.

4. Finally, we identified The timing of the initial project report, notebook and intermediate evaluation to ensure that the content of these sections was submitted on time.

*Results:* We confirmed the initial division of labour among the group members, and verified that everyone had an appropriate division of labour and was capable of completing the mid-term progress assessment successfully.

*Conclusion and suggestions for future experiments:* Following a week of clarifying roles and responsibilities, everyone would began working on their assigned tasks this week, with a plan to report and integrate the system at the same time next week.

*Recorded by:* Gu Xingci

**Third week group meeting**

*Date:*Wednesday, 8 March 2023, 13:00 PM-16: 15 PM

*Purpose:* First week’s progress reports and system integration

*Procedures:*

1. To start, Chen Xi gave a detailed briefing on motor, explaining that he had purchased a motor and tweaked its module to better regulate the robotic arm's motion. He also recommended that, once everyone had finished their individual reports, the team’s group members should go on to completing their group reports.

2. Followed that, the PCB integration team led by Sun Linhan, Guo Linhong, and Zou Hanlin stated that they would try to convert the Arduino code to STM32 to meet course requirement. As the two chips' design and programming language were different, they needed to make some adjustments to guarantee the code's correctness and stability.

3. Li Chenghao and Liu Cehan, who were in charge of communication, said that two key parts of their current effort were fixing RTCs and transferring data via HC12. Among these was real-time clock debugging, in which they were trying to utilise a Nucleo-L432KC chip to retrieve the time over the I2c protocol.

4. Yuan Ye and Yang Chun, who were in charge of the OpenMv module, said that they first conducted a field trip to the pavement conditions of our school's East Lake, and Sheng Dian also went to confirm the terrain conditions to ensure that the chassis and wheels of the rover he designed could maintain a smooth progress on gravel ground and flat stone pavement.

5. After all group members debriefed, everyone focused on the problem of how to identify road signs in task 2.1. There are currently two schemes to achieve the recognition of arrows through machine learning algorithms, and the other is to directly identify triangles and rectangles; the final result of the discussion was the former. It was decided to ensure the basic functions of the rover to complete the task of midterm display. Secondly, every team members was concerned with finishing task 2.2, which entailed throwing small balls, using the motor to operate the robotic arm and also had requirement of the 3D printer arm. The current discussion was led by Chen Xi to finish the content of the servo, while Sun Cehan and others were responsible for assisting modelling and finishing the task of 3D printing of the robotic arm. Finally, I wrote everyone's report in detail on the electronic notebook in order to find everyone's corresponding progress and make timely adjustments.

*Results:* Modules have been developed for the project, and our team discussed system integration. Everyone on the team known what he needed to do to move his part of the project forward.

*Conclusion and suggestions for future experiments:* The robot's system building was taking shape. This week, team members should continue develop the partially assembled modules they were accountable for and talked to each other about the coordination and communication issues arisen between the modules.

*Recorded by:* Gu Xingci

**Third week day-to-day progress：**

*Purpose:* Improve some group's modules

*Date*: Friday, 10 March 2023.

*Purpose:* Adjust the communication content of each module by communication team members, including Li Chenghao and Liu Cehan.

*Procedures:*.

1. To lessen the burden on the main control's memory and boost the stability of time communication, they've settled on a communication system with a different design in which the main control and communication module were split.

2. In the end, they settled on the DS3231 as their RTC after considering other options. By using an external crystal oscillator, Beijing time can be pre-programmed into the system. The module then functions as an independent clock, enabling time processing even during a blackout.

3. They decided to jump into the coding, Their proposed starting procedure framework is as follows: The HC12 receives an enable signal from the main control stm32 (H7 series) when the tram reaches the predetermined location. The signal is received by the HC12, and then the L432kc receives data via the UART protocol from the stm32L432kc linked to the HC12. The L432kc then uses the time read from the RTC (DS3231) crystal oscillator module as a buffer after receiving the command. After that, the PC receives the group's name and time through USB and displays it.

*Results:* The planning of the communication system has already taken shape, and on top of this, it was ensured that the programming of the communication module was partially completed before the next group meeting

*Recorded by:* Gu Xingci

*Date:*Saturday, 11 March 2023.

*Purpose:* Improve the OpenMv pathfinding system by OpenMv programming team members, including Yuan Ye and Yang Chun.

*Procedures:*

1. Based on observations made during field trips. their team established that the OpenMv

camera might perform the duty of road surface patrol: the surface used for the patrol

line was a sparse gravel pavement, while the surrounding pavement was a flat stone pavement. And the camera was required to send a signal to the rover, which might

determine the direction of the current small car based on the signal's intensty.

2, They chose to use the CANNY operator for edge detection of the pavement. while the

edge of the standard pavement was sparse, the edge of the patrol line surface was thick

and complex. The next step involved detecting as many edges as possible. hence a higher

resolution was needed.

3. After heated discussion. they finally chose to use the Mean operator to lighten the

load on the subsequent computations, involving adaptive binarized and image fltering.

Next step was to apply mean pooling on grayscale photos to identify pavement in areas

where there were many edges.

*Results:* OpenMv Camera's path detection has been provisionally done. thus the team moved on to discussing how to establish communication with Sheng Dian's rover chassis in preparation for their next group meeting

*Recorded by:* Gu Xingci

*Date:*Sunday, 12 March 2023.

*Purpose:* Adjust servo and robot arm module by Chen Xi

*Procedures:*

1. After a heated discussion at the third week group meeting, Chen Xi carefully evaluated the design of the robotic arm and the selection of servo.

2. The original concept for the control module he was tasked with was as follows: when the rover was in front of the trash can, the master (STM32) sends a PWM signal to the robotic arm, which then rotated 180 degrees and drops the ball into the opening at the bottom of the frame. For the ball to be successfully deposited into the frame, the trolley's servo and robotic arm would be elevated above the frame via a platform.

3. For three reasons, he settled on this basic structure. One, it was easy to build (requiring only a single servo), and two, it was lightweight and takes up little room. Inherent in its bridge-type construction, the PLC material was surprisingly lightweight. Using this layout, you could save some space. Three was Personalization. We was able to adjust the drive rod's length, thickness, and interface type thanks to the 3D model. Also, you coulf alter the appearance of several objects, including the tennis ball used in the mission.

*Results:* He had a rough plan for his robotic arm's control system and hoped to have some of programming part and some of the parts 3D-modeled and printed by the time of the next group meeting next week.

*Recorded by:* Gu Xingci

*Date:*Sunday, 12 March 2023.

*Purpose:* Write initial report based on the progress they reported to me.

*Procedures:*

1. I listened to some of the group's day-to-day development and jotted down my

observations in the digital version of the notebook.

2. Then I drafted the Initial report's Abstract, Introduction, and Task Content Introduction

based on the partially formed system framework.

*Results:* The notebook is half flled with entries by the due date. and a draft of the initial

report has been created.

*Recorded by:* myself

*Conclusion and suggestions for future experiments:* The focus was mainlly on adjusting the communication content of each module and the robot arm, improving the OpenMv pathfinding system and writing initial report, And intended to report on the progress and handover of modules in the next group meeting.

**Fourth week group meeting**

*Date:*Tuesday, 14 March 2023, 14:00 PM-16: 05 PM

*Purpose:* Second week’s progress reports and system integration

*Procedures:*

1 First, Sheng Dian carefully reported the chassis he was now correcting. After receiving

the progress of the OpenMv camera in charge of Yang Chun and Yuan Ye. he was picking

modules, first deciding that the chassis wheels should utilise the Mecanum wheel.which

alowed wheels to synthesise force in any diretion. Then it was determined that the main

control OpenMv and the chassis motor to carry out UART communication. Through the

calculation, the motor get the corresponding speed assigned to each Mecanum wheel.

2. After the basic work of Sheng Dian's chassis was finished. the fllowing groups with

day-to-day weekly progress last week reported separately. The OpenMv camera's team,

including Yang Chun and Yuan Ye reported last week on the car's basic pathfinding

progress and discussed the code operation. They would next finish task2.2's machine

learning-based garbage Can recognition with arrow icon recognitiont

3. At the same time. Chen Xi. the robotic arm's in-charge designer, displayed his 3D-

modeled portion of the arm. pointing out that the component frame can reserve a 3mm

border for the pitch to prevent the ball from getting stuck in the custom 3D printing. but

that the original model is simple and needs to be iterated and raised to achieve the

process of throwing into the trash.e

4. The members of the communication team including Li Chenghao and Liu Cehan said

that they should accelerate the programming part of the communication module content.

As Beiing time was pre-injected via the external crystal osillator module, they used the

DS3231 as RTC. Nucleo-L432KC used the time read from the DS3231 crystal osilltoarl

module after receiving the signal to perform buffring. The time and the group's name

were then sent to the computer via USB and shown there."

5.Ireported | have fnished the half of notebook content. and also indicated thatIwould

continue to drafting the report's initial version.

6. Yang Chun and Yuan Ye gave chassis designer Sheng Dian OpenMv's orders and

signals during module handover. Chen Xi. who eass in charge of the robotic arm. exports

the 3D modelling diagram to the students in charge of the document for writing the

report part, and Li Chenghao and Liu Cehan also hand over their communication module

to Sun Linhan. Guo Linhong. and Zou Hanlin, who were all working on PCB and

document integration, let their group be responsible for drawing the schematic and

system-design writing.

7. The students who were in charge of the prior phase would make enhancements to the

system next week. while the students who would be in charge of the phase ater that

would create the matching modules in the fourth week fllowing the handover of the

prior phase. | meticulously reorded everyone's reports in the digital notebook so that |

could track down their individual improvements and make necessary adjustments.

*Results:* After submitting third-week progress, our team discussed how to integrate the system and finish later modules.

*Conclusion and suggestions for future experiments:* The students promoting the early project continue to build and improve the module. The students in charge of the handover to complete the communication interaction with the early progress and the early progress and developing their later modules.

**Fourth week day-to-day progress：**

*Date:*Friday, 17 March 2023,

*Purpose:* Begin working on the PCB design and the top-level system integration by PCB and document integration team members including Sun Linhan, Guo Linhong, and Zou Hanlin.

*Procedures:*.

1.

*Results:* 还没想好

*Date:*Saturday, 18 March 2023,

*Purpose:* Adjust the communication content of each module by communication team members, including Li Chenghao and Liu Cehan.

*Procedures:*.还没想好

*Results:* 还没想好

*Date:*Sunday, 19 March 2023.

*Purpose:* Improve the OpenMv pathfinding system by OpenMv programming team members, including Yuan Ye and Yang Chun.

*Procedures:*

1. Based on observations made during field trips. their team established that the OpenMv

camera might perform the duty of road surface patrol: the surface used for the patrol

line was a sparse gravel pavement, while the surrounding pavement was a flat stone pavement. And the camera was required to send a signal to the rover, which might

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and complex. The next step involved detecting as many edges as possible. hence a higher

resolution was needed.

3. After heated discussion. they finally chose to use the Mean operator to lighten the

load on the subsequent computations, involving adaptive binarized and image fltering.

Next step was to apply mean pooling on grayscale photos to identify pavement in areas

where there were many edges.

*Results:* OpenMv Camera's path detection has been provisionally done. thus the team moved on to discussing how to establish communication with Sheng Dian's rover chassis in preparation for their next group meeting

*Recorded by:* Gu Xingci

*Date:*Sunday, 19 March 2023.

*Purpose:* Write initial report based on the progress they reported to me.

*Procedures:*

1. I listened to some of the group's day-to-day development and jotted down my

observations in the digital version of the notebook.

2. Then I drafted the Initial report's Abstract, Introduction, and Task Content Introduction

based on the partially formed system framework.

*Results:* The notebook is half flled with entries by the due date. and a draft of the initial

report has been created.

*Recorded by:* myself

*Conclusion and suggestions for future experiments:* The focus was mainlly on adjusting the communication content of each module and the robot arm, improving the OpenMv pathfinding system and writing initial report, And intended to report on the progress and handover of modules in the next group meeting.

**Fifth week group meeting**

*Date:*Wednesday, 23 March 2023, 14:00 PM-16: 05 PM

*Purpose:* Third week progress reports and midterm assessments

*Procedures:*

*Results:*

*Conclusion and suggestions for future experiments:*

*Recorded by:* GuXingci