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NATIONAL INSTITUTE OF BUSINESS MANAGEMENT

HIGHER NATIONAL DIPLOMA IN SOFTWARE ENGINEERING

COURSEWORK

Robotics Application Development

Pet Robot (01st Progression)

SUBMITTED BY

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Date of Submission: 17th of January 2025

Contents

1. Problem Definition

The proposed robotics application is a smart pet robot with following functions.

- Performs rotating, moving forwards and backward, tilting the head, wagging the tail
- Follows the user
- Emits sounds
- Avoids obstacles
- Neck belt which lights up corresponding to background darkness automatically

The above-mentioned functions are planned to control using commands given through a laptop. The purpose of implementing a pet robot is to replicate the traditional pet with an automated pet to provide the owner with companionship, entertainment and convenience with certain limitations. With the busy life cycle of the current population, their need is to minimize their workload and maintain their mental fitness. Therefore, the proposed pet robot will be suitable for the current generation as it reduces the maintenance cost and time for a traditional pet as it is automated, only needs a repair if any technical issues were met and it helps to enhance the mental well-being of an individual as well.

Basic requirements which are expected from the pet robot is to perform following activities.

- Perform functions mentioned in above
- Detecting obstacles and avoiding
- Identifying the background darkness

As per the above problem definition, the proposed pet robot will assist the user with its owned functions to replace a traditional pet with a robot instead.

2. Researching and Designing

2.1 Researching

According to the proposed robot, the focus of the implementation is given to its movements and functions performed. The following electronic components are needed to build the pet robot to function as expected.

01. Motors

- **Servo Motors** Facilitates implementing movement processes such as tilting the head, wagging the tail.
- DC Motors used to make the robot move front, backwards and rotate.

02. Sensors

- **Infrared sensors** are used to prevent the robot from hitting obstacles as it detects the object.
- **Ultrasonic sensor** is used to place the object away from the obstacle with a fixed distance because it can measure the amplitude between itself and the obstacle.
- **LDR sensor** which is on the neck belt of the pet which lights up in dark backgrounds automatically.

03. Arduino Board

- Considered as the brain of the robot as it is responsible for grabbing the inputs and controlling output using selected components.

04. Breadboard

- Used to connect components together in the circuit.

05. LED bulbs

- Used to light up the neck belt.

06. Lithium-Ion battery

- It is the power source for robots.

07. Motor Shield

- Used to control multiple servo motors in the robot

08. Buzzers

- This component is used to get audio output from the robot

09. Wires and Connectors

- Used to connect each component together.

10. DC Motor Controller

- Used to controller the speed and direction of the motor

11. Chassis

- The base structure which holds all the components of the robot.

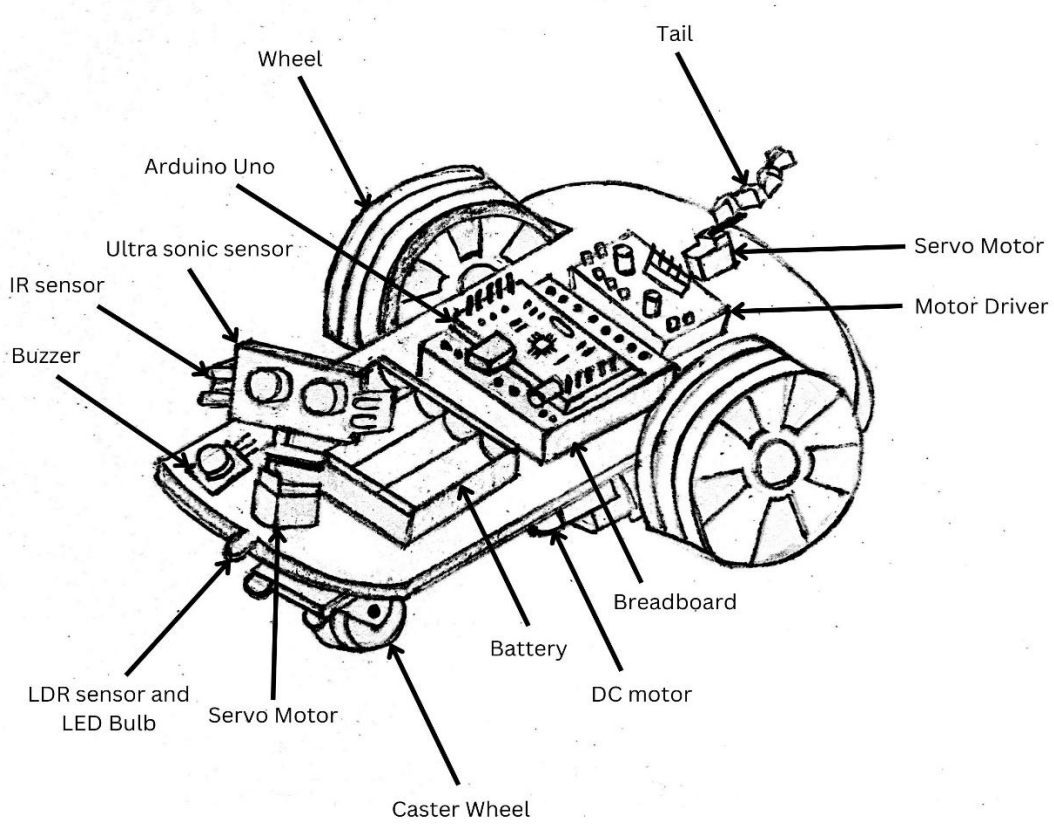
12. Resistors

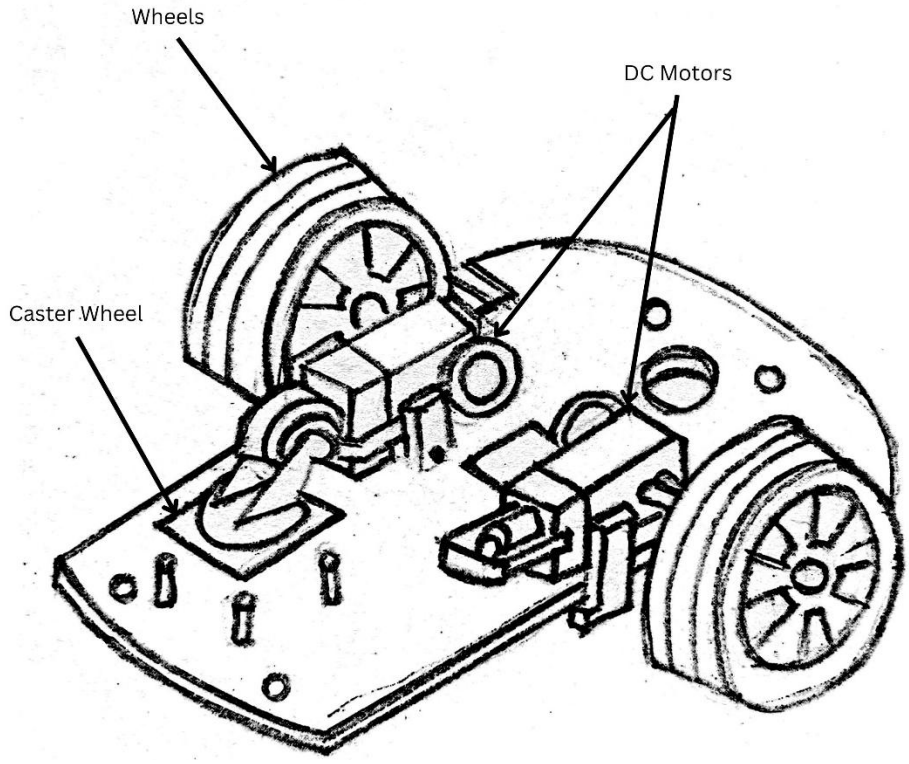
- Used to control the flow of electricity.

Apart from the above devices more tools and materials are needed to design the external appearance and fix the model as designed. Those will be mentioned in the fourth chapter.

2.2 Designing

Following is a sketch of the pet robot to display where the certain components are added.





3. Build the Robot (BOM)

To build the robot, the following tools, components and equipment are needed. They are listed as a bill of materials (BOM).

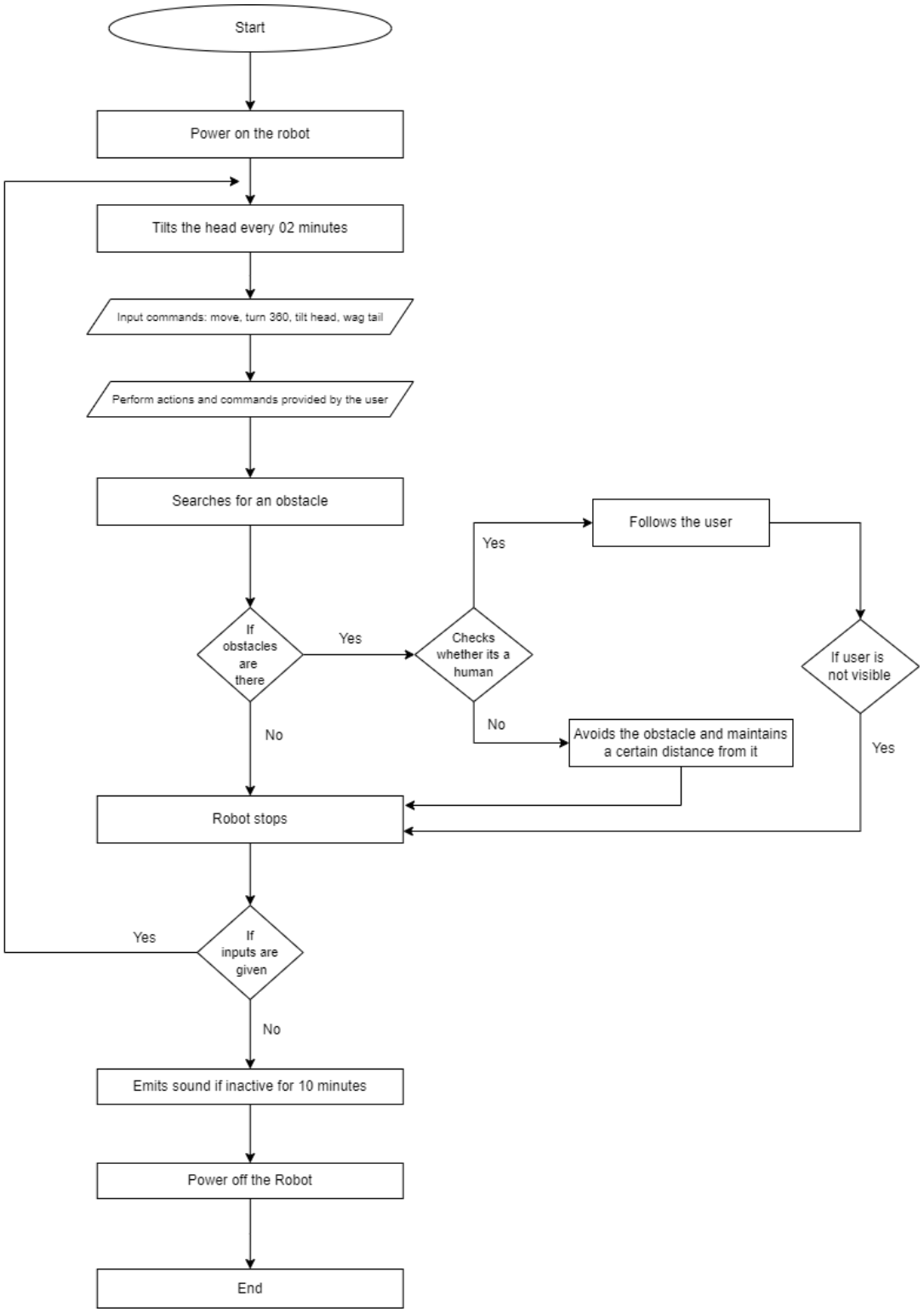
Component	Quantity	Amount (Rs)	Total(Rs)
Chassis	01	2500	2500
Servo Motors	02	390	780
IR Sensor	02	190	380
LDR Sensor	01	260	260
Ultra Sonic Sensor	01	250	250
LED Bulbs	01 pack	80	80
Arduino Uno	01	2250	2250
Jumper Cables (male to male)	01 pack	380	380
Jumper Cables (female to female)	01 pack	270	270
Jumper Cables (male to female)	01 pack	270	270
Lithium-Ion battery (3500mah)	690	08	5520
DC Motor	04	60	240
Motor driver	01	490	490
Buzzers	01	80	80
Switch	01	50	50
Breadboard	01	290	290
Charging case	01	240	240
Glue Sticks	06	40	240
Glue Gun	01	720	720

Nuts	As requires	100	100
Soldering Iron	01	790	790
Soldering Wire	01 role	120	120
Soldering Iron Stand	01	490	490
Scissor	01	150	150
Glue (normal)	01	115	115
Bristol Board	01	55	55
Super Glue	01	95	95
Paper Cutter	01	200	200
Double Tape	01	750	750
Plier	01	1470	1470
Resistors	01 pack	50	50
Other		200	200

Total Amount			**Rs 20055.00**

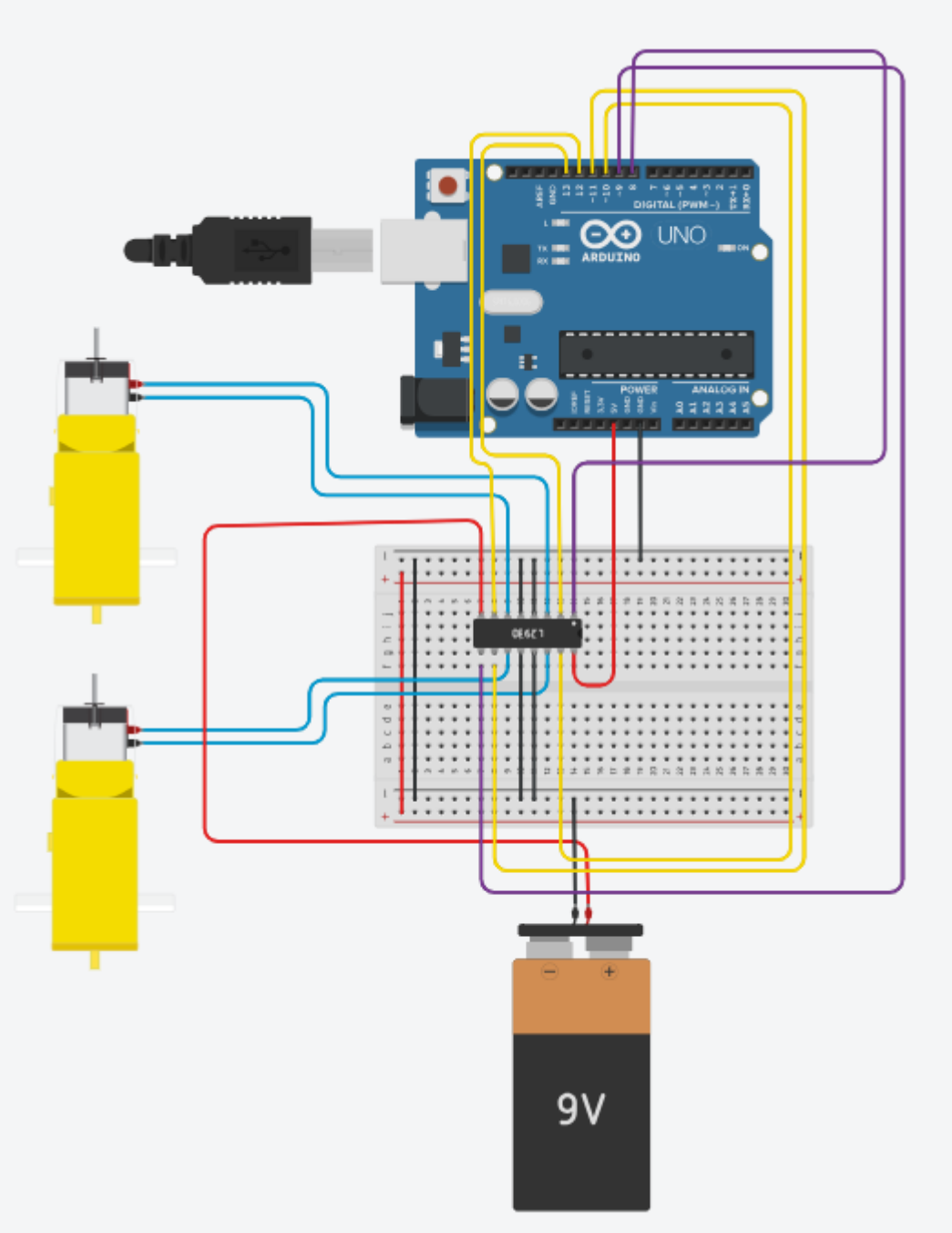
4. Programming (Flow Chart)

According to the proposed project, the process of the robot can be displayed using a flow chart as follows.

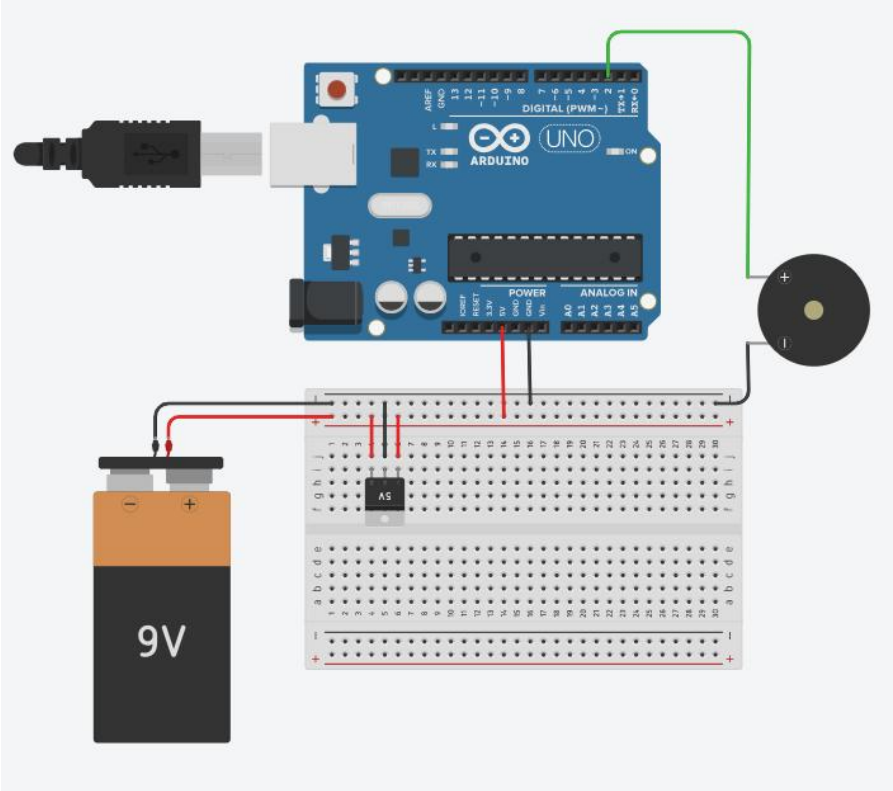


5. Circuit Diagram (Simulation)

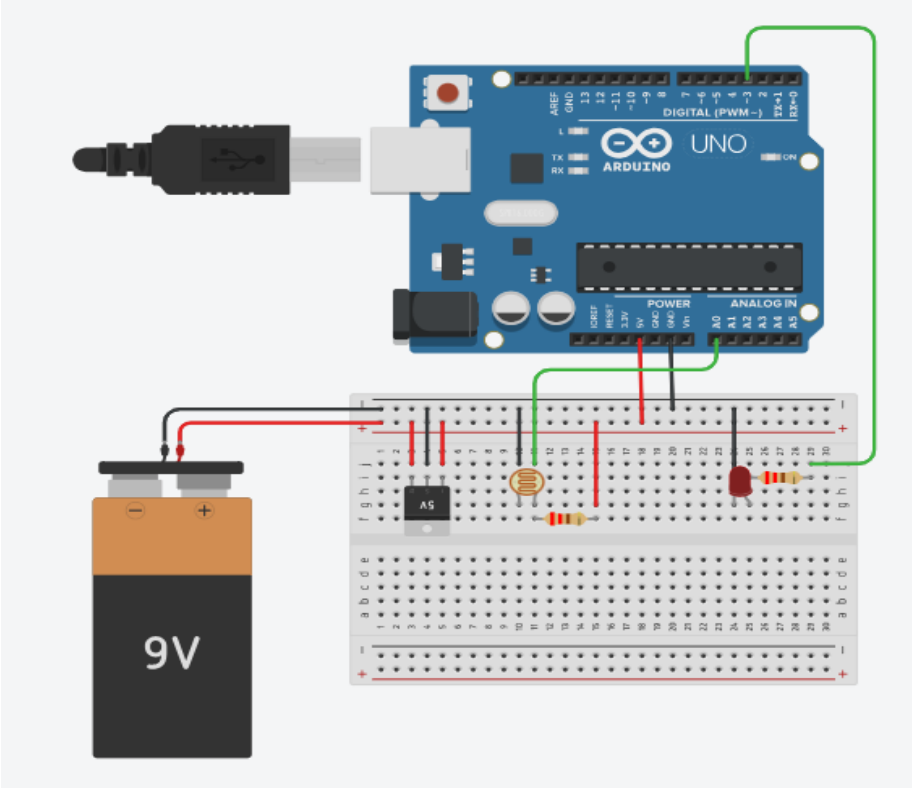
1) Move



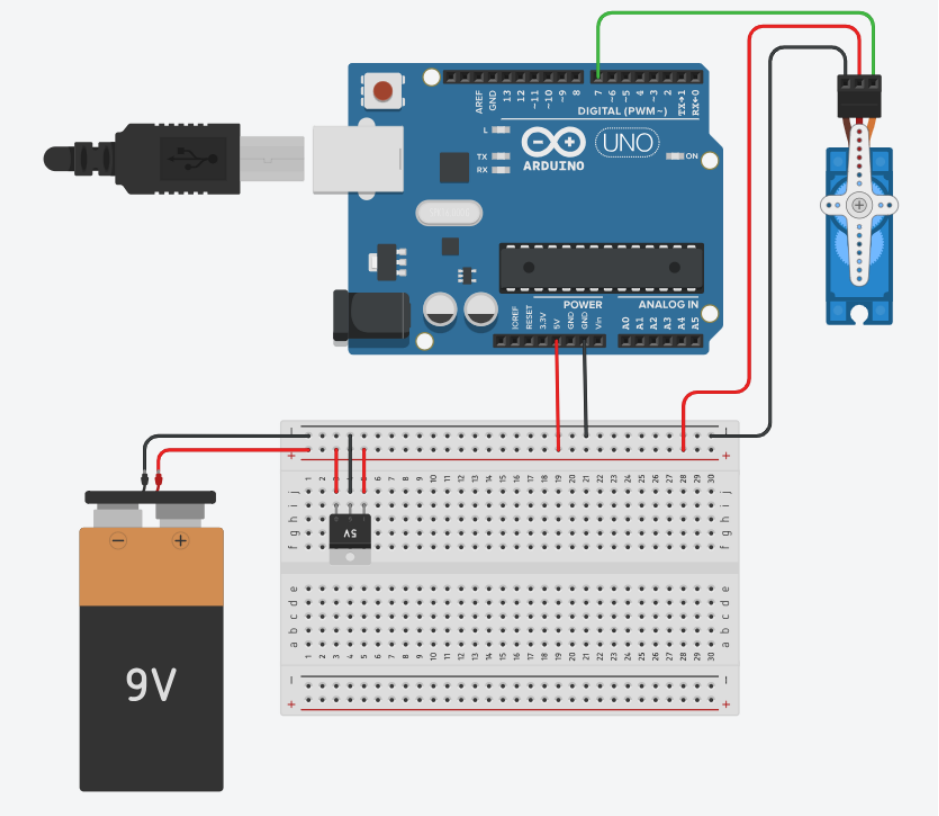
2) Buzzer sound if user inactive for 10 minutes



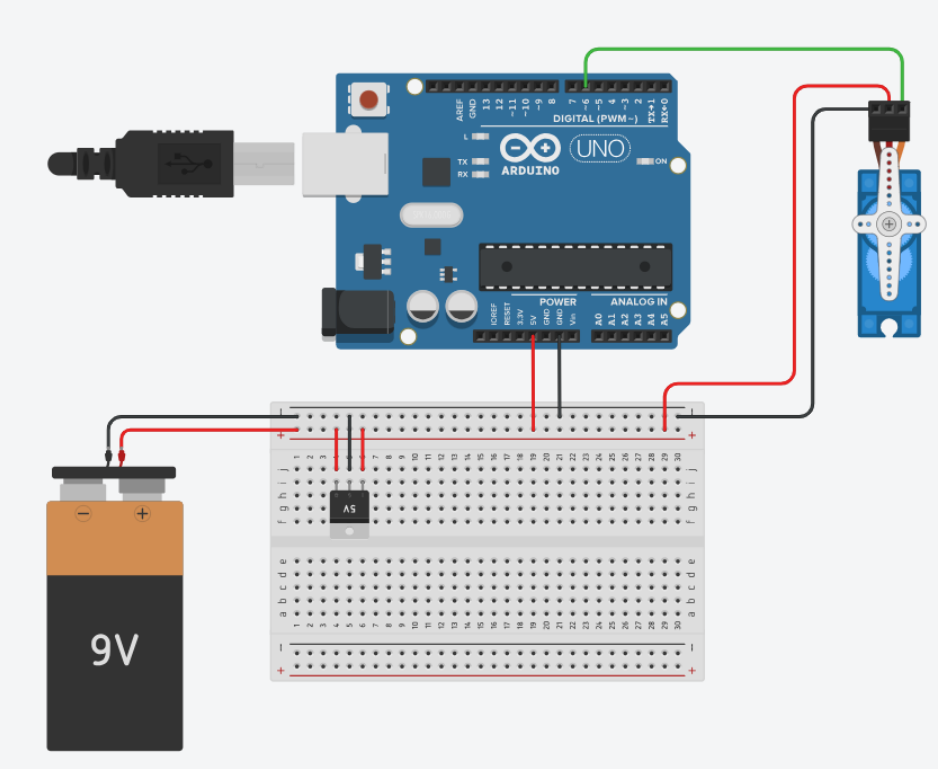
3) LDR sensor on neck belt to light up automatically in dark times



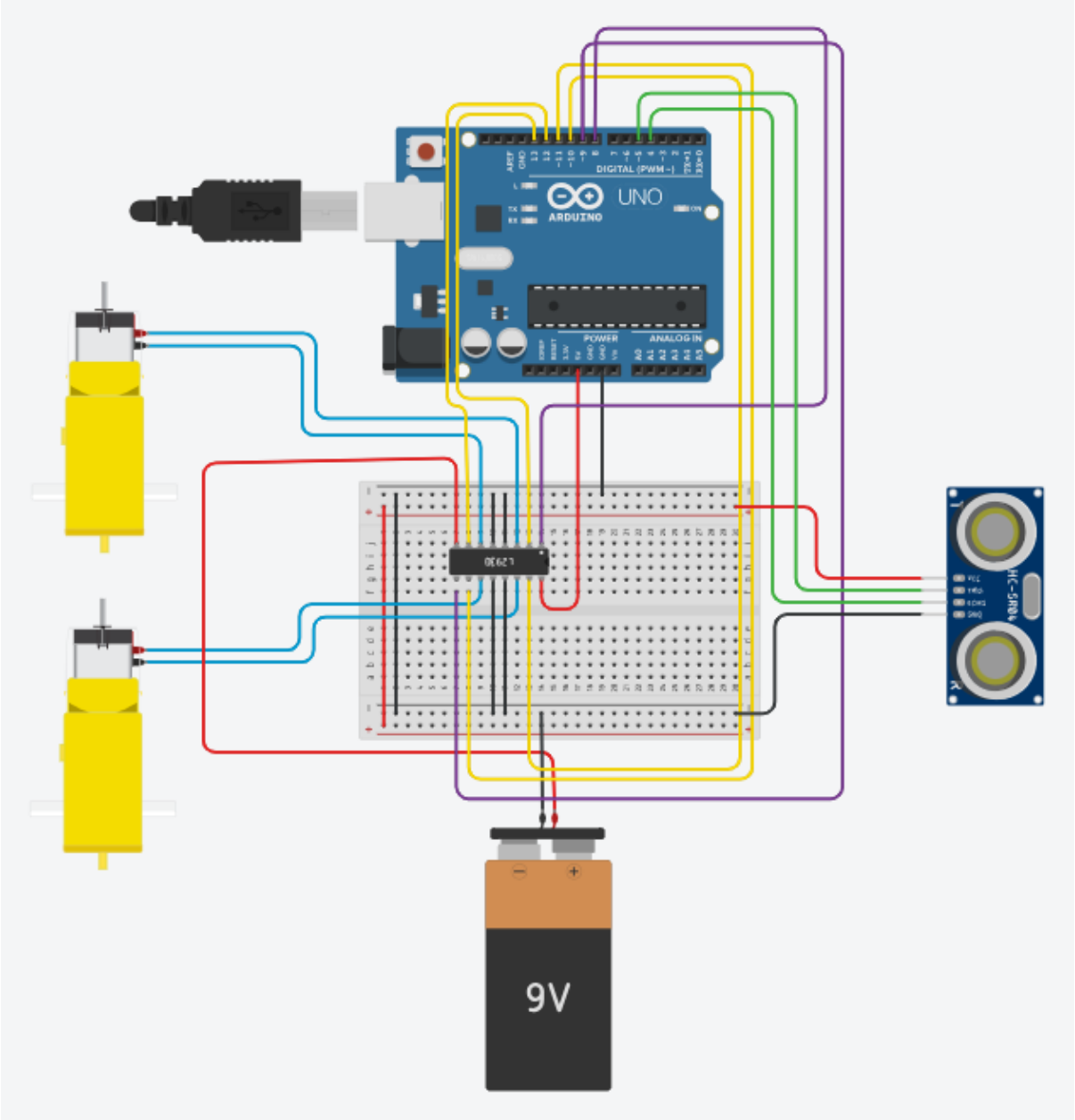
4) Tilt the head twice every 02 minutes



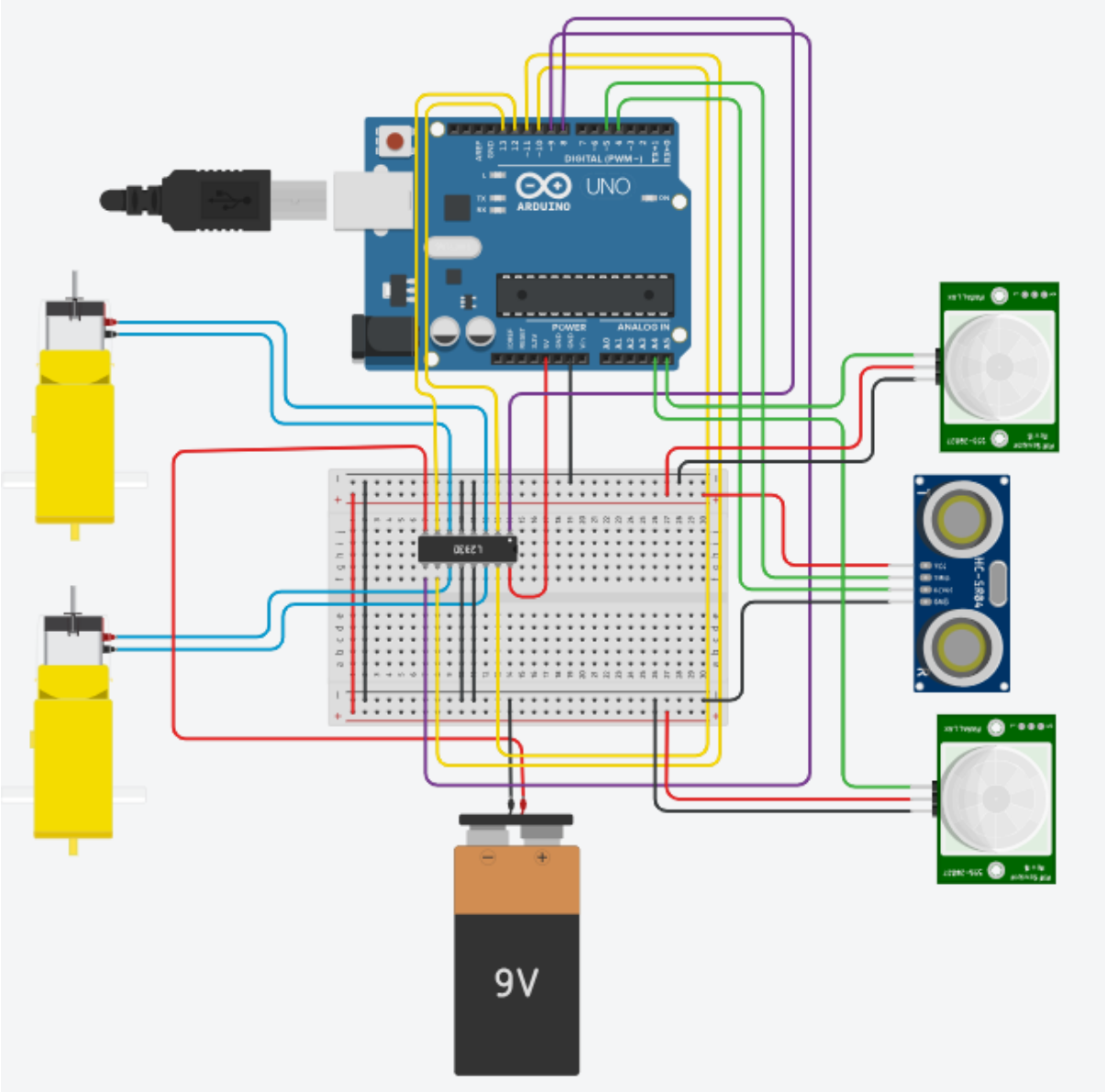
5) Wag tail



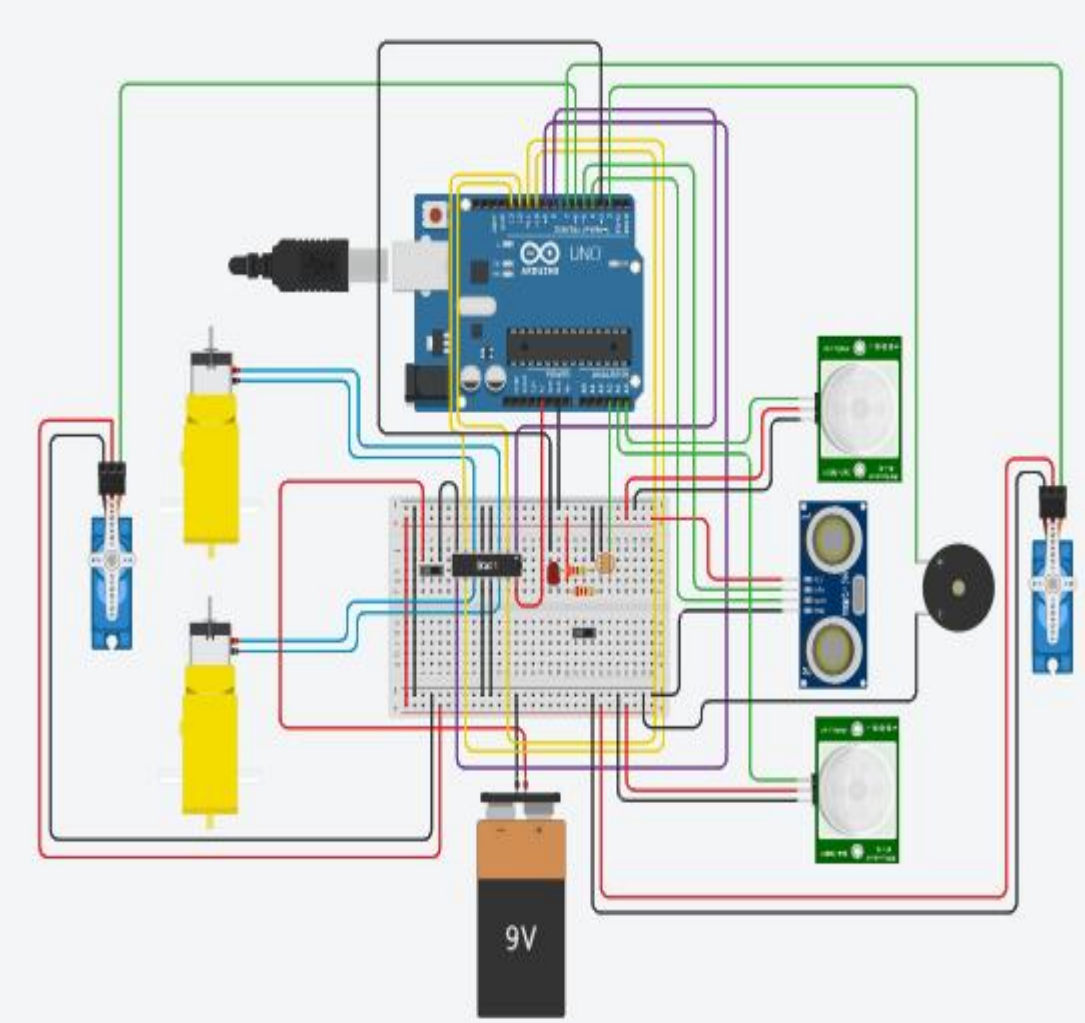
6) Avoid obstacles



7) Follow the user



8) Overall Design



6. Evaluating the robot

6.1 Results of the operation

Once the robot is implemented and ready to work, it will start to work according to user commands and by following the user.

The user can command by laptop to perform actions such as rotating, moving forwards and backward, tilting the head, wagging the tail and while the operation happens, if any obstacle is detected it will stop automatically while emitting a sound in certain times.

6.2 Limitation

As for the limitations of the project, the following can be considered.

- Some output and action errors may occur as the sensors may not work perfectly due to environmental changes.
- The robot will only trigger relevant user commands because it is designed to perform only certain tasks.
- Hardware may wear out with time and regular maintenance and fixes are required.
- The initial cost for implementing a robot is high.
- Battery life will be stored for a small time period, and it is needed to recharge.
- Limited storage of certain components cannot store large amounts of data.
- The robot cannot locomote across uneven surfaces smoothly.
- High and low temperatures will affect certain functionalities of components.
- Overtime usage may heat the system and cause failures.

6.3 Recommendation

As the future recommendations,

- Artificial intelligence can be applied to identify environmental changes and advance performance
- Can implement the robot to understand and identify selected users voice and emotions to provide more likely pet feeling using biometric sensors.
- Allow to respond to virtual assistants such as Alexa
- Implement data security measures.
- Enhance the design which is eco-friendly to prevent harm to environment.

In conclusion, the proposed project will act as a pet instead of a traditional pet in order to the need of owner for their ease of use.

7. Timeline

Phases	Week 01	Week 02	Week 03	Week 04	Week 05	Week 06	Week 07	Week 08
Define the objectives								
Research and Feasibility Study								
Concept Design and Planning								
Prototyping the Hardware								
Coding the robot								
Testing the functions								
Debugging the errors								

1. Define the objectives
   Find out a problem statement by researching a problem in the society and create a solution through a robot.

2. Research and Feasibility Study
   Research about the relevant hardware components to implement the robot.

3. Concept Design and Planning
   Gathering all those hardware components and make the connection in between them.

4. Prototyping the Hardware
   Creating an outer cover with relevant hardware components to depict the shape of a pet with additional hardware components and connections.

5. Coding the robot
   Choosing a programming platform and program the robot according to needed functions.

6. Testing the functions
   Run the robot and identify its errors and areas to improve.

7. Debugging the errors
   Debug and modify the robot with relevant modifications.