Cyber Physical System – CS626

Course Instructor – Dr. Gourinath Banda

Project – 1

Team members:
Gaurav jain : 200001023
Navya Harshitha : 200003064

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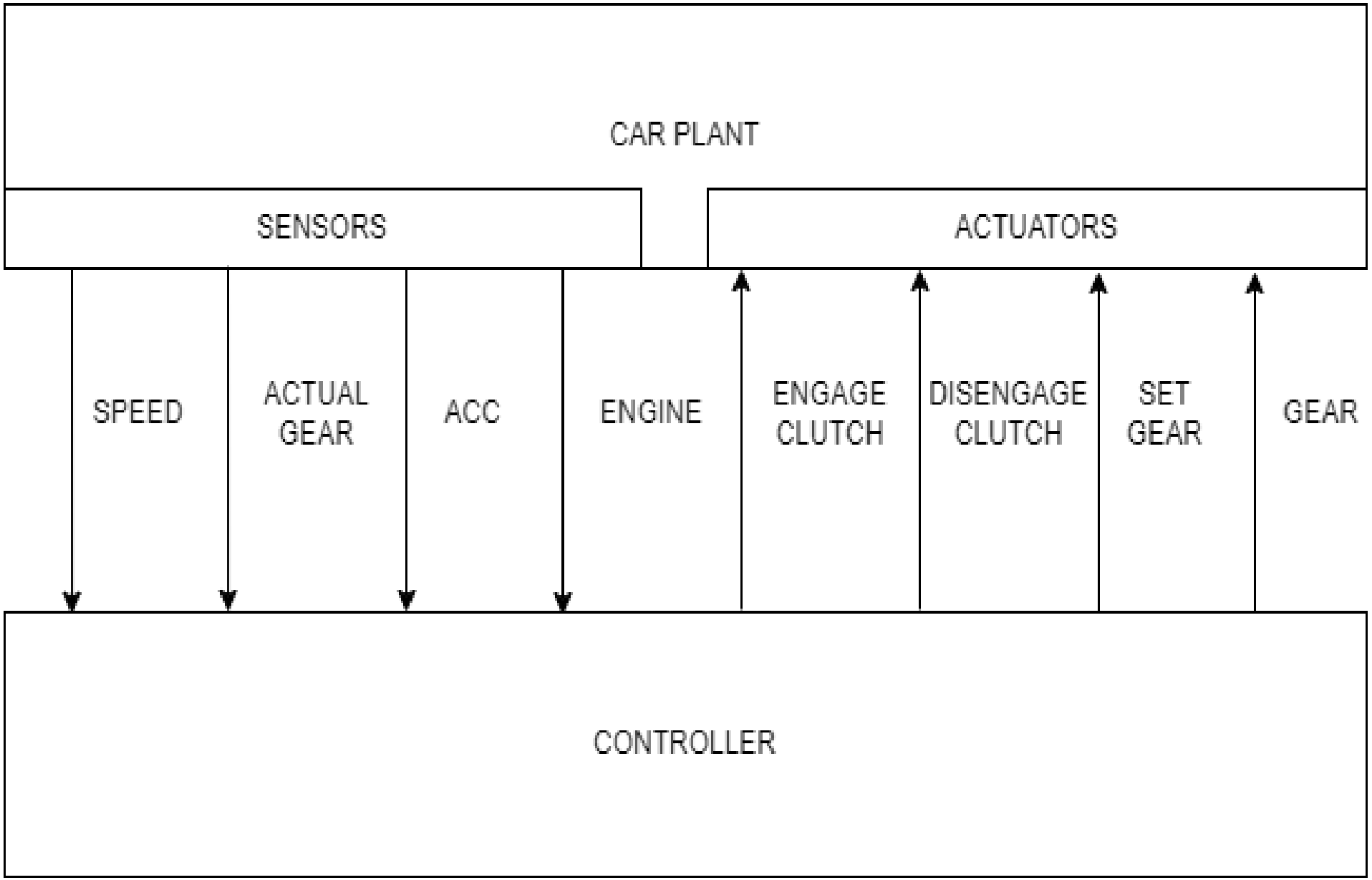
Project Problem

We need to design a CPS that automates gear transmission in accordance with the speed requirement requested by the driver in the fuel-based automotive car. When the vehicle is at lower speeds, an appropriate lower gear needs to be engaged; for higher speeds an appropriate higher gear needs to be engaged. While a gear is engaged/disengaged clutch is activated.

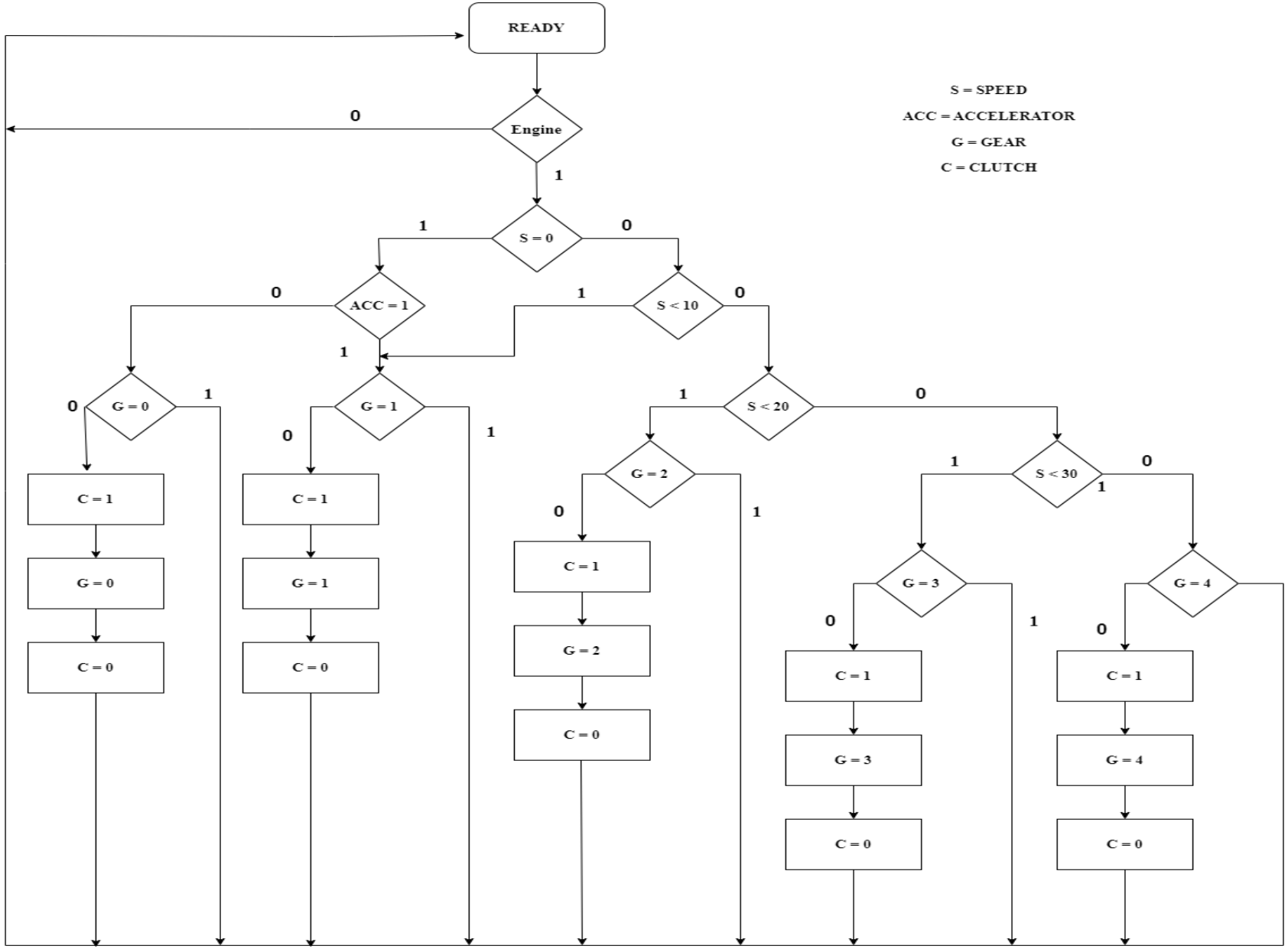
Speed in (0,10] : Gear 1
Speed in (10,20] : Gear 2
Speed in (20,30] : Gear 3
Speed greater than 30 : Gear 4

INTERACTION BETWEEN PLANT AND CONTROLLER



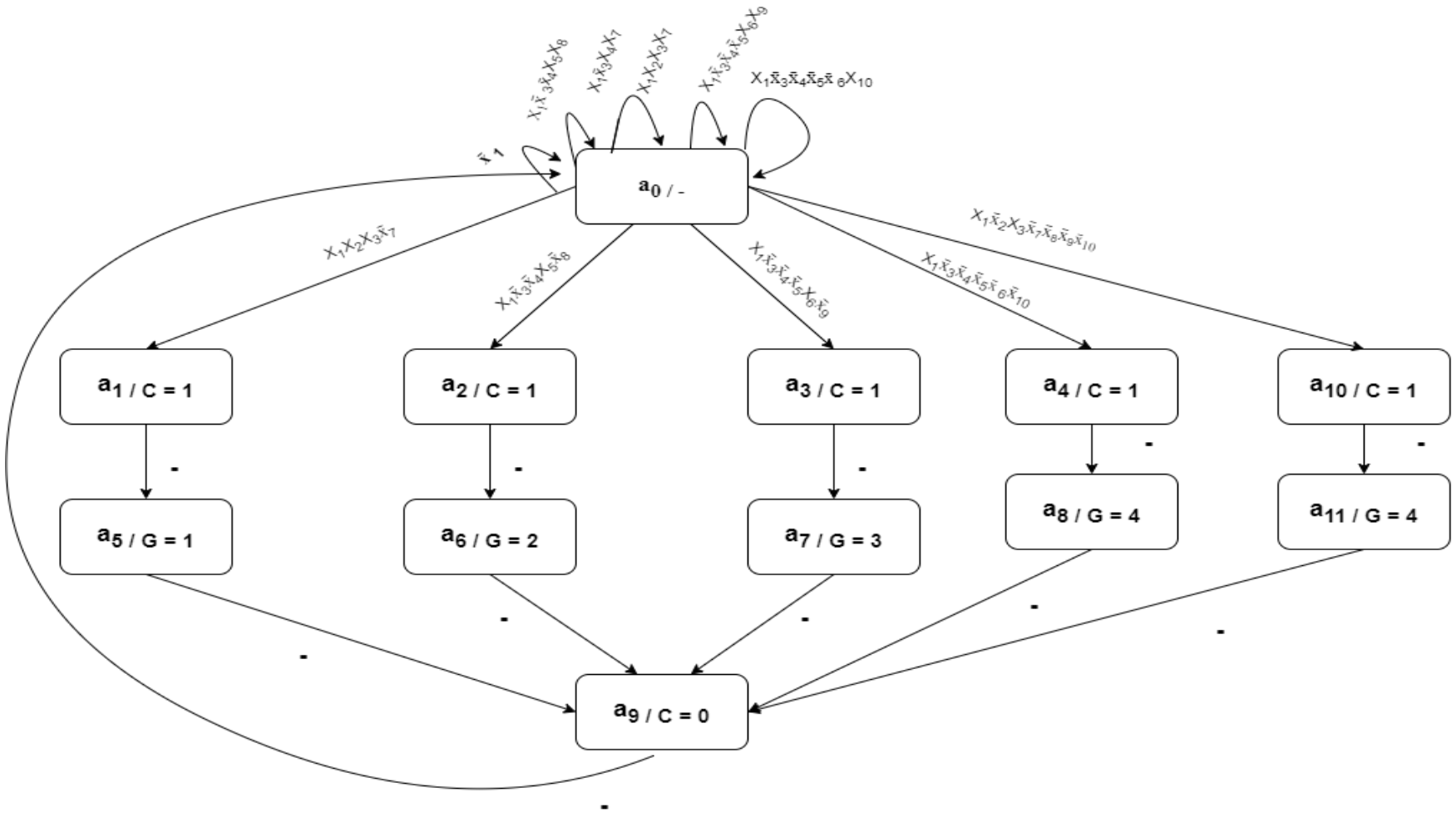
STATE MACHINE MODEL REPRESENTATIONS

Car Controller : STATE MACHINE FLOWCHART



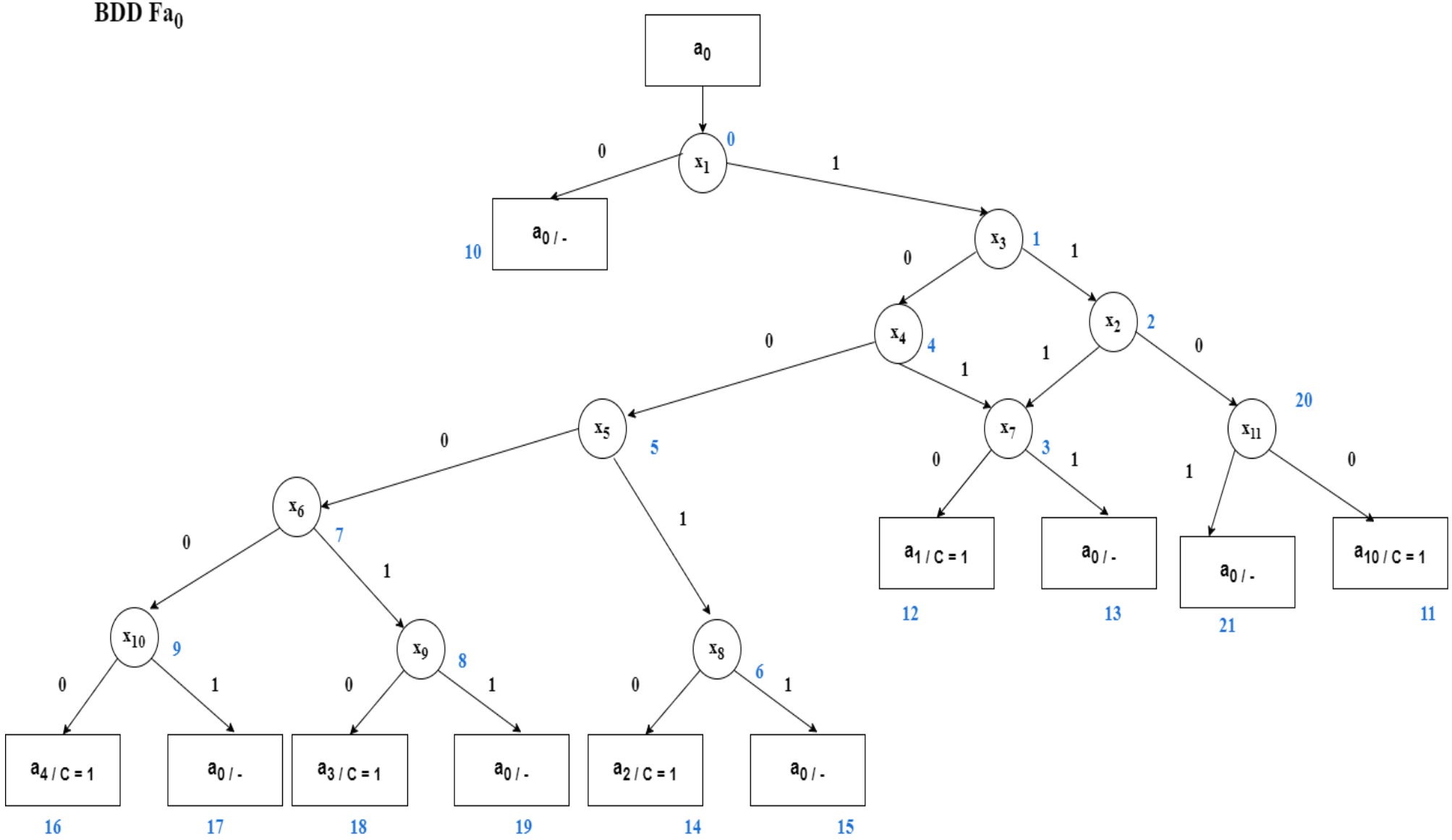
STATE MACHINE SEQUENCE DIAGRAM

Car Controller : Moore machine



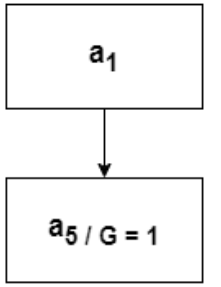
Binary Decision Diagrams for Next-State Mappings

BDD Fa_0



STATE MACHINE MODEL REPRESENTATIONS

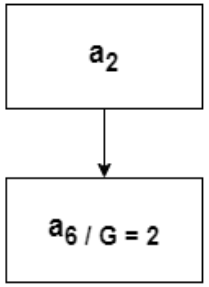
BDD Fa_1



22

$Fa_1 = a_5(-)$

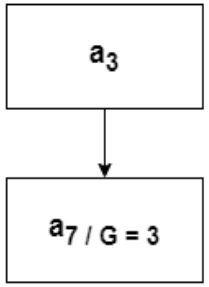
BDD Fa_2



23

$Fa_2 = a_6(-)$

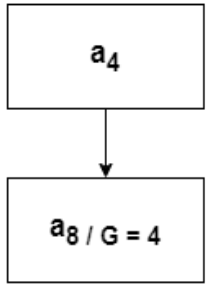
BDD Fa_3



24

$Fa_3 = a_7(-)$

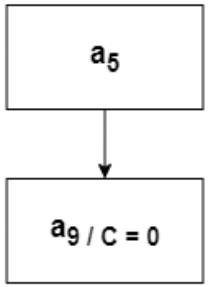
BDD Fa_4



25

$Fa_4 = a_8(-)$

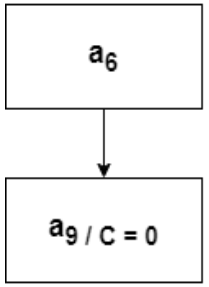
BDD Fa_5



26

$Fa_5 = a_9(-)$

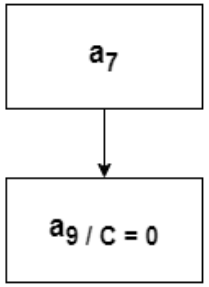
BDD Fa_6



27

$Fa_6 = a_9(-)$

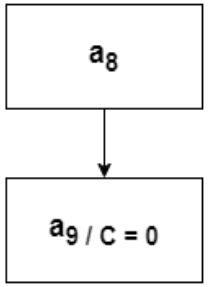
BDD Fa_7



28

$Fa_7 = a_9(-)$

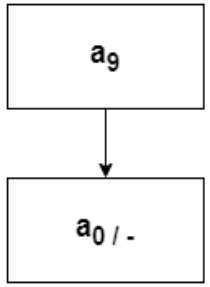
BDD Fa_8



29

$Fa_8 = a_9(-)$

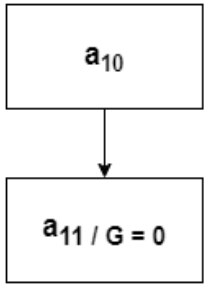
BDD Fa_9



30

$Fa_9 = a_0(-)$

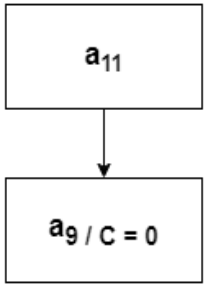
BDD Fa_{10}



31

$Fa_{10} = a_{11}(-)$

BDD Fa_{11}



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$Fa_{11} = a_9(-)$

State Logic Controller Implementation

	clutch	clutch	change gear	gear	immediate transition
	Y0	Y1	Y2	Y3	
a0	0	0	0	0	0
a1	1	0	0	0	1
a2	1	0	0	0	1
a3	1	0	0	0	1
a4	1	0	0	0	1
a5	0	0	1	1	0
a6	0	0	1	2	0
a7	0	0	1	3	0
a8	0	0	1	4	0
a9	0	1	0	0	1
a10	1	0	0	0	1
a11	0	0	1	0	0

WORKING OF PROJECT

DEMO

THANK YOU