# Traffic Light Controller

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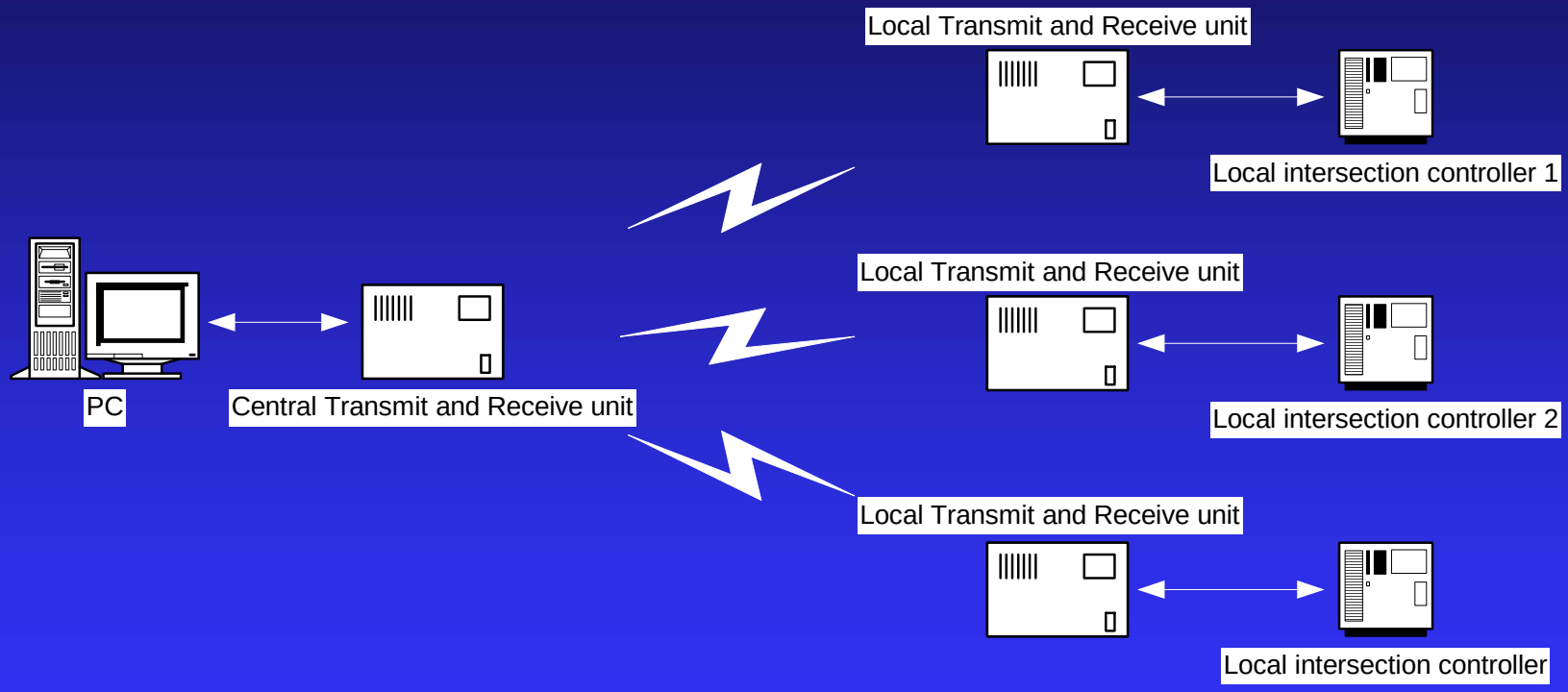
# Project Goals

- Design an independent traffic light controller.
- Implement network coordination
- Design of central controller

# System Overview

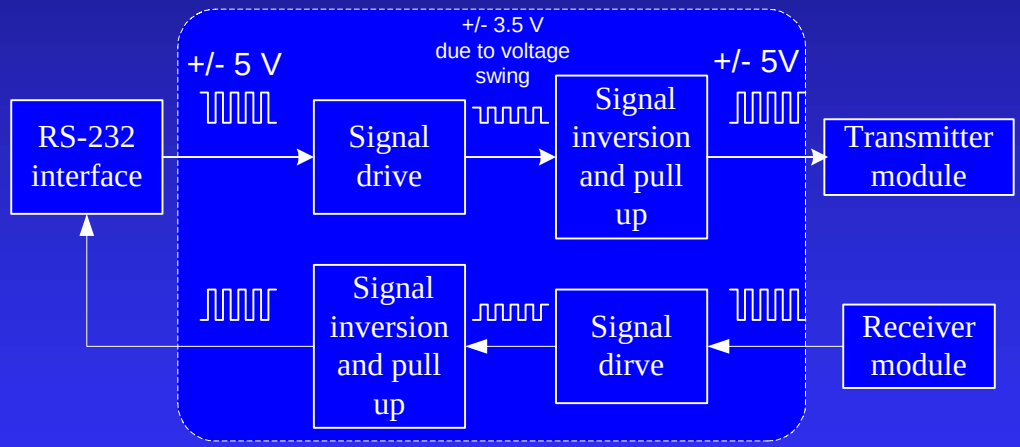


# Traffic Control Schemes

- Pre-Timed
- Vehicle Actuated
- Coordinated Network

# Serial Communication

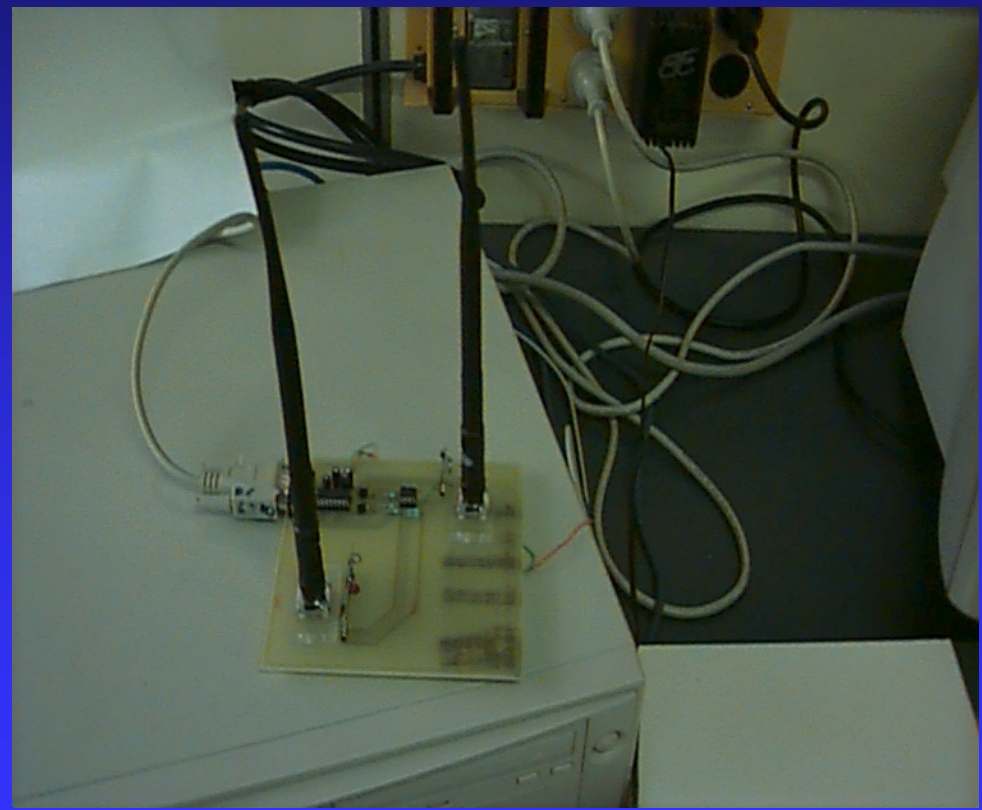
- MAX232 module



# Central Transmit and Receive Unit

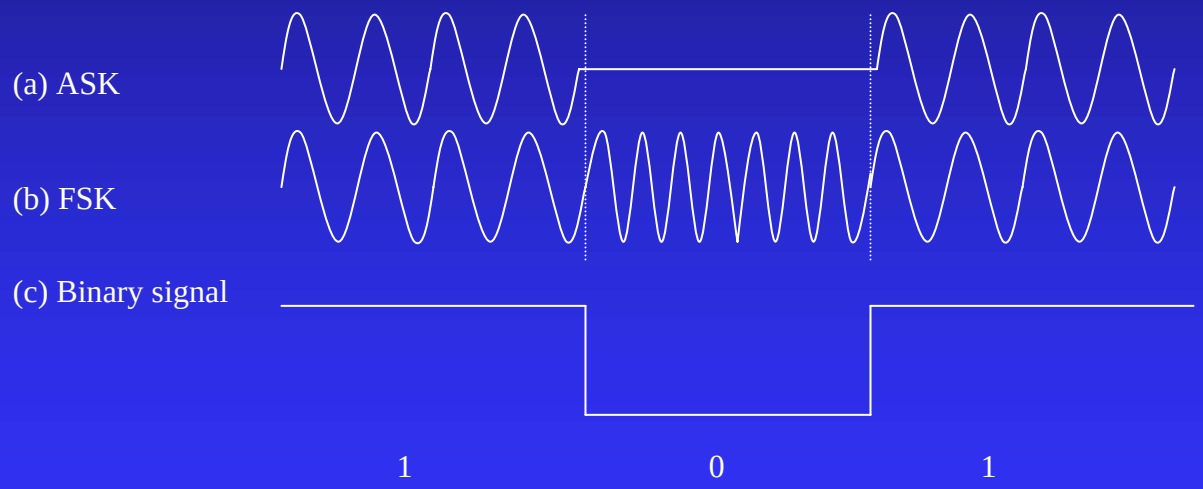
- Serial interface
- Communication devices.

  (RF modules)



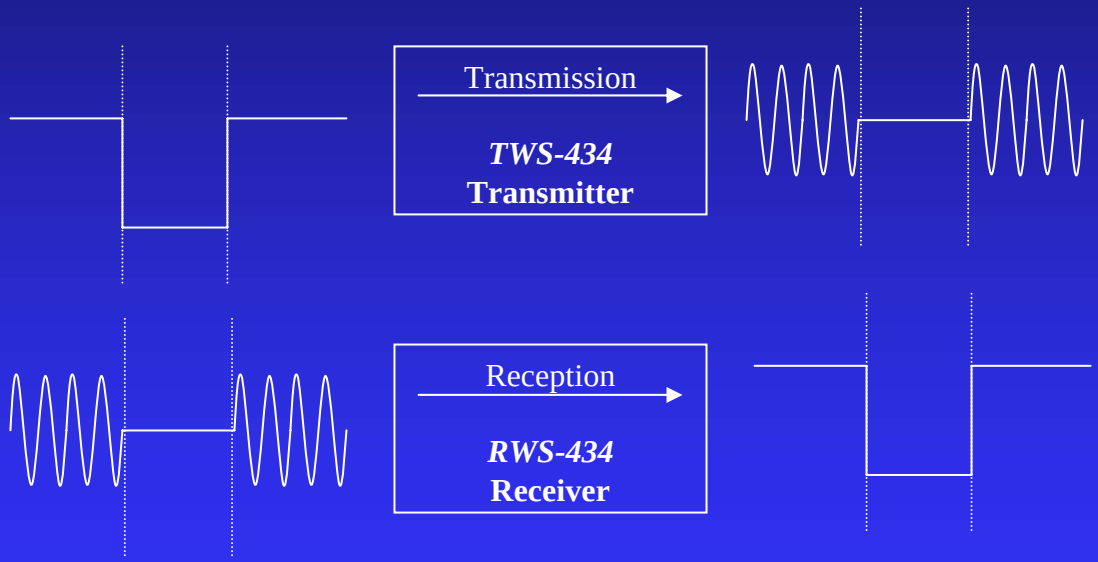
# Communication Techniques

- Amplitude Shift Keying
- Frequency Shift Keying



# ASK Scheme

- TWS-343 and RWS-434

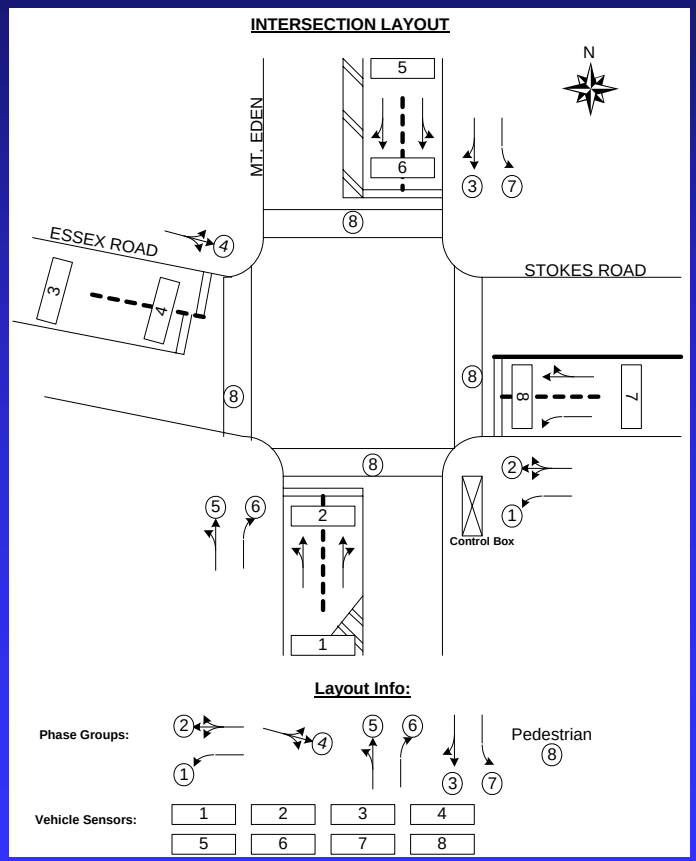


# Micro-processor M16

- 87 I/O ports
- 5 UART channels for serial communication
- Technical support

# Case Study

# Phase Diagram




| Phase Group | A | B | C | D |
|---|---|---|---|---|
| 1 | OFF | GAN | OFF | OFF |
| 2 | R | R | GAR | R |
| 3 | GAR | R | R | R |
| 4 | R | R | GAR | R |
| 5 | SGGA | SGAR | R | R |
| 6 | SOFF | GAR | R | R |
| 7 | SGAR | OFF | OFF | OFF |
| 8 | R/OFF | R/OFF | R/OFF | GR |

A preceding S means some form of special control of signal group.

GAR – Green Amber Red
R – Red

GAN – Green Amber Off
R/OFF – Red or Off

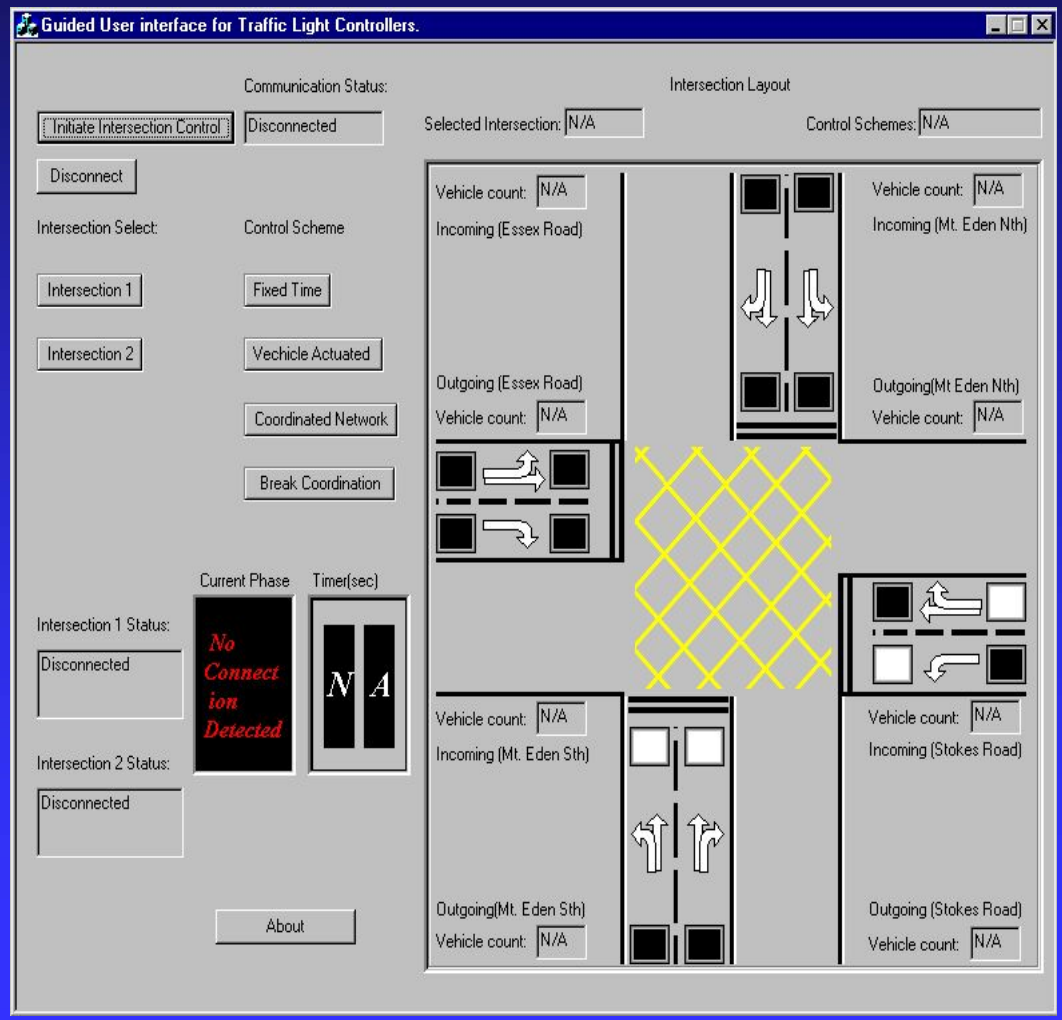
Start Phase : A
Phase sequences: BACD

# The Developed System

- Master controller
- Two local intersection controllers

# Software Interface

- Traffic control schemes.
- Intersection feedbacks.



# Communication Protocol Between GUI – Local Controllers

- Error control (maintain data integrity)
- Access control (eliminates data collision)

# Protocol Basics

- Error Control : Checking digits on data packet.
  - Parity bit & block sum check : Can only detect single bit errors.
  - CRC : Cyclic Redundancy check, capable of detecting burst errors.

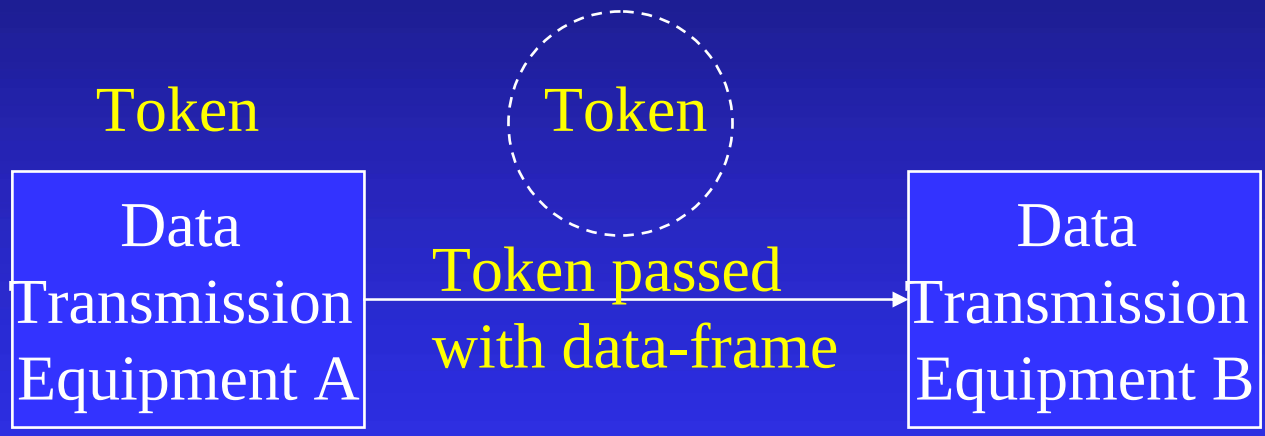
# Protocol Basics (continue..)

- Access Control : Allocate link usage to the communicating parties.
  - Token access control : Circulate data transmission token to eliminate data collisions

# Token passing: operation principles


DTE A wishes to send a data to the DTE B, it must first wait for the receipt of the control token.

# Token passing: operation principles




On receipt of the token, DTE A initiated transmission of the frame and then passes the token to DTE B.

# Token passing: operation principles


DTE B has the token and therefore able to reply to DTE A.

# Token passing: operation principles


On receipt of the token, DTE B initiated transmission of the frame and then passes the token to DTE A.

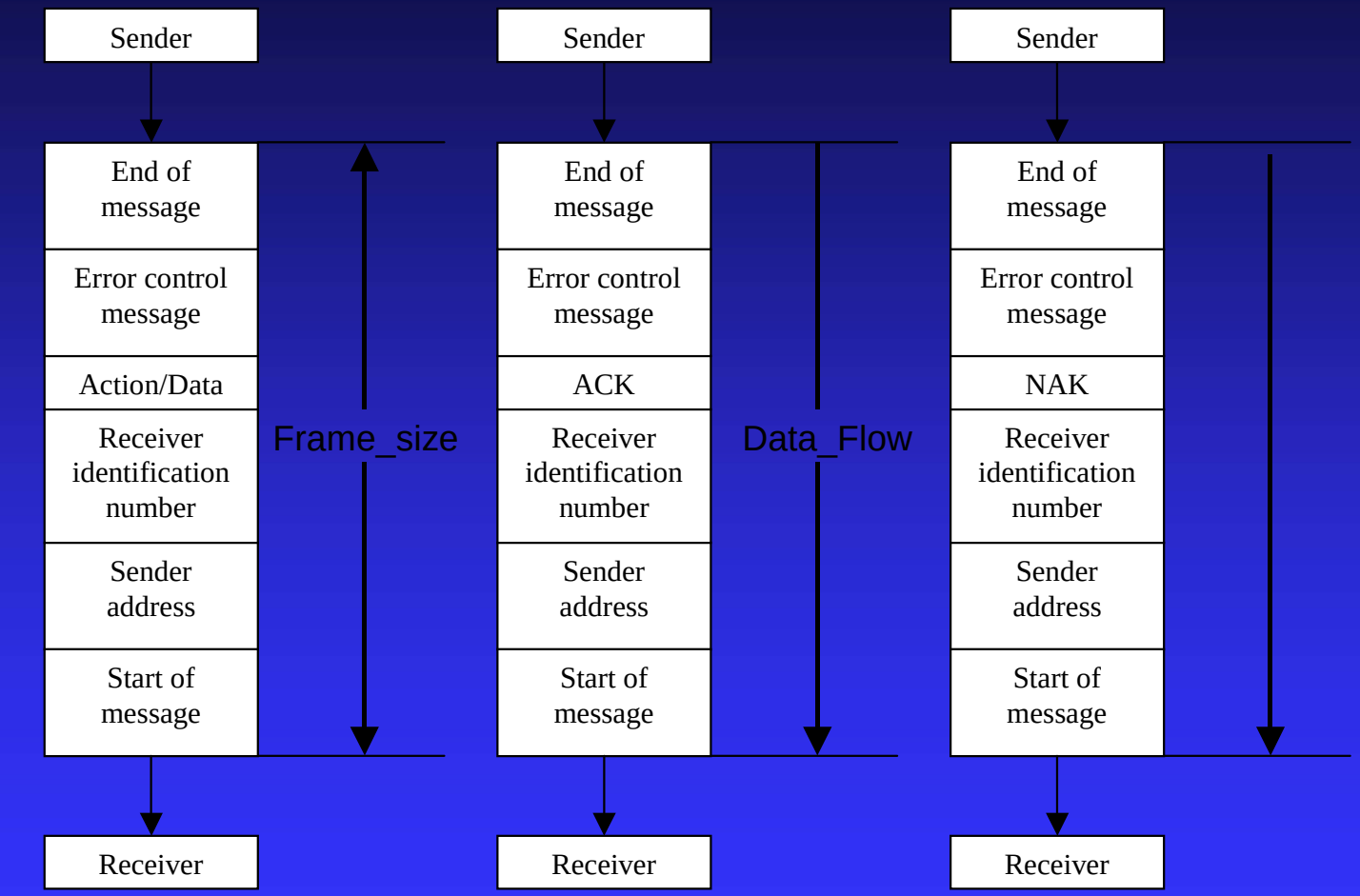
# Token passing: operation principles


The process repeats itself whenever a data frame is successfully passed between the two communicating parties.

# GUI-Local Controllers Protocol

- Idle RQ ( idle repeat request )
  - Wait for acknowledgements from last transmissions before sending another frame.
- Token access control
  - Enforce one party transmission rule.

# Protocols Data Format



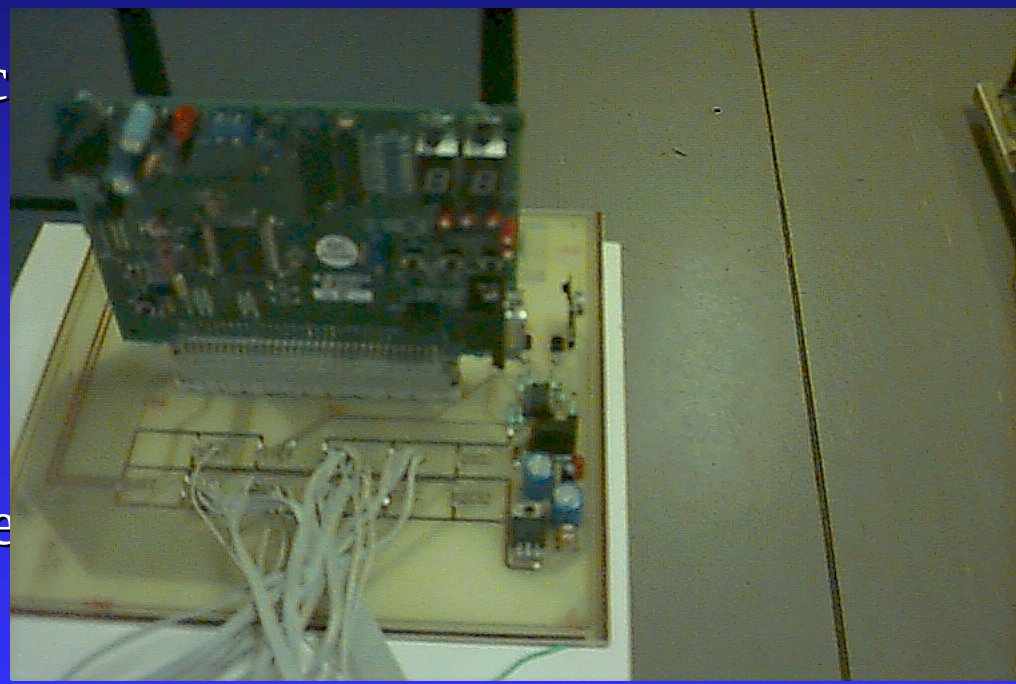

a) Data frame

b) acknowledgement frame

c) negative acknowledgement frame

# The Local Controller

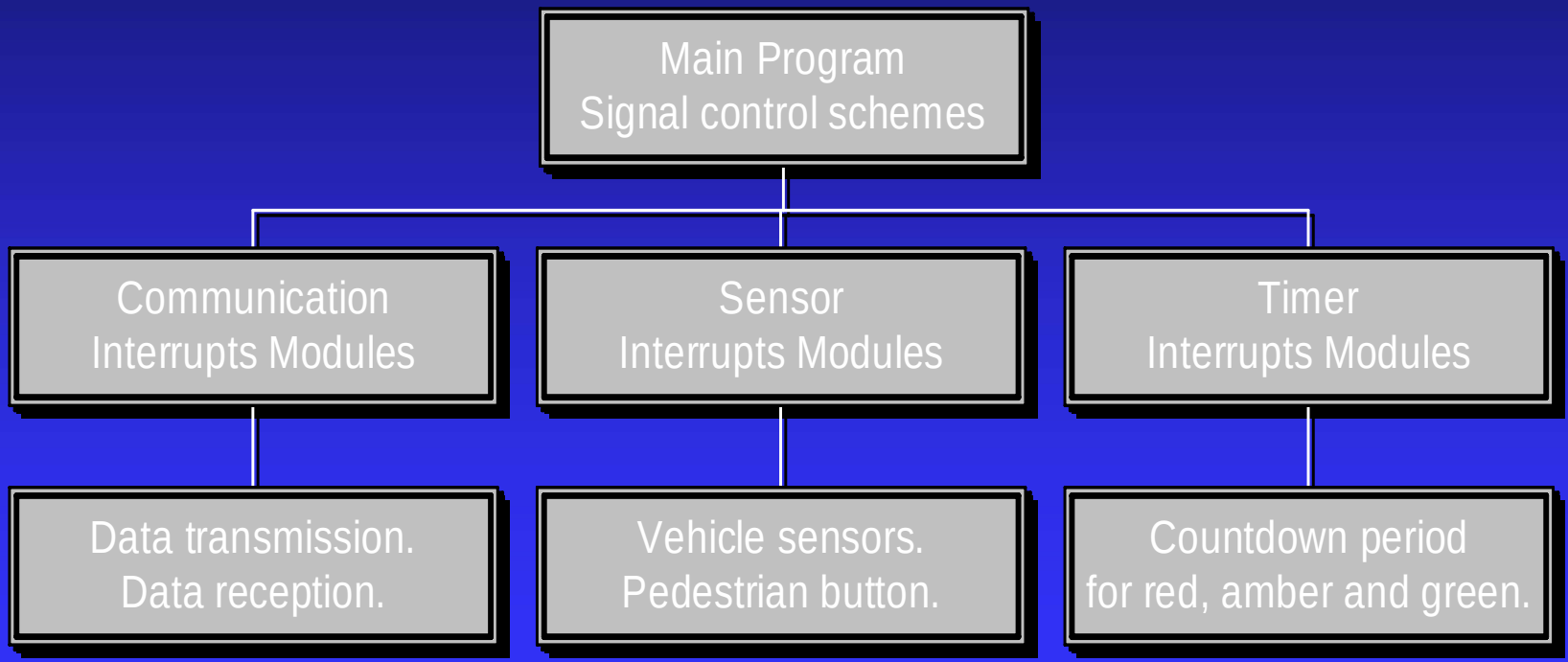
- Local transmit and rec
  unit,
- I/O ports and,
- MCU (micro-controlle



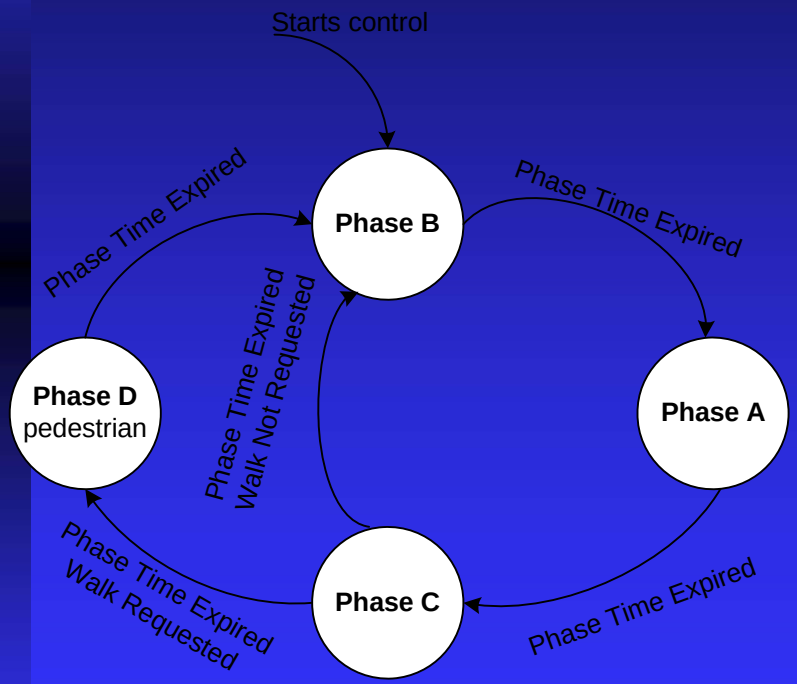
# MCU software implementation

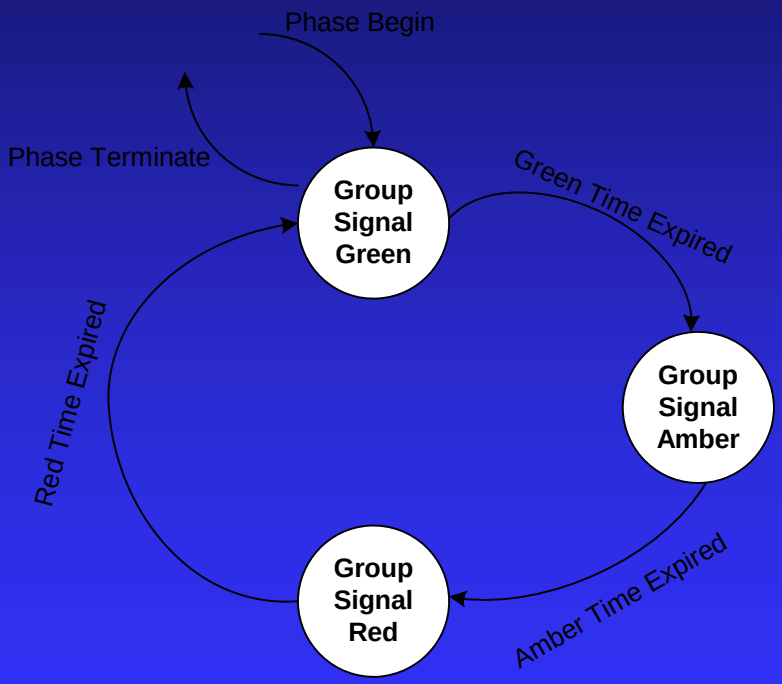
- Recognizing control commands.
- Manages control of traffic signal.
- Reporting intersection status.

# Program Hierarchy



# Signal Control Method



# Testing of the system

- Communication range 45cm, with the miniature model intersection.
- Reliable data communication between the local controllers and the GUI master modules.

# Limitations

- Operating range and, (1-3 meters with line of sight)
- Speed of the communication devices. (3000 bits per second or 300 bytes per seconds)

# Future Improvements

- Network class protocols.
- Better data transmission devices.
- Sophisticated software interface for the local controllers.

# Conclusions

- An independent Traffic light controller based on the case study.
- Final traffic control system is fully operational.
- Main project objectives are achieved.