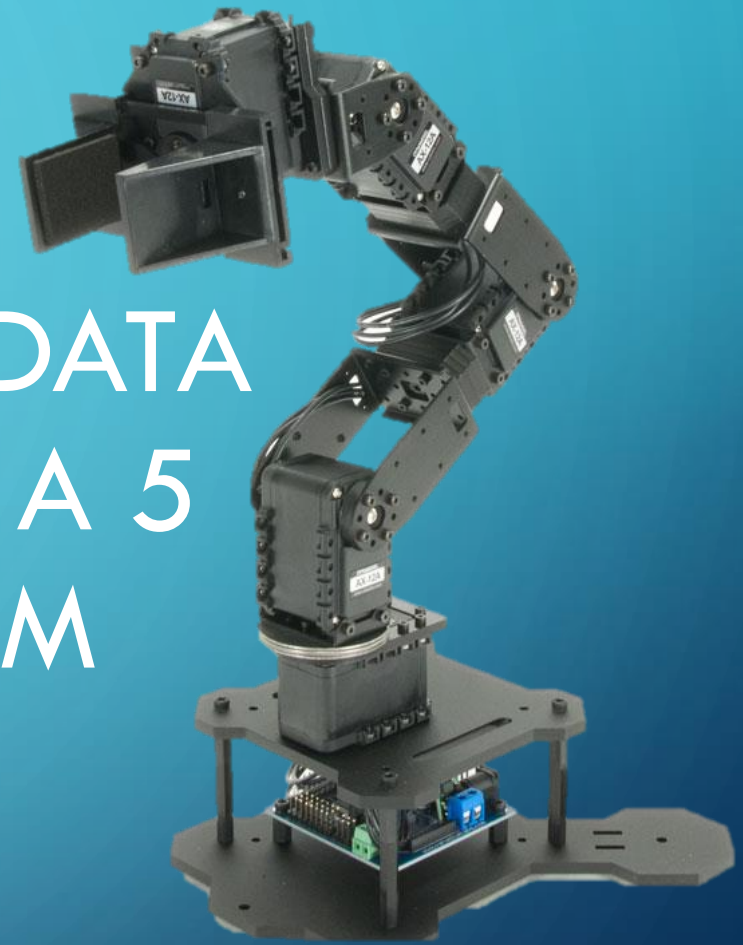


REAL-TIME CLOCK-BASED DATA LOGGING SUBSYSTEM IN A 5 DOF ROBOTIC ARM SYSTEM

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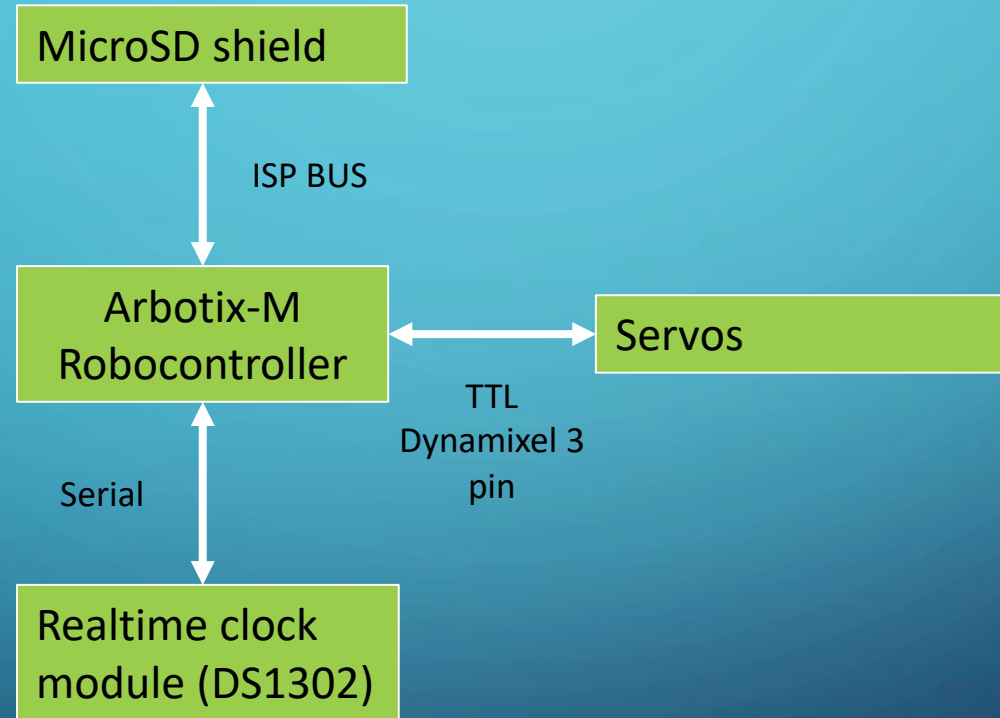
TASK DESCRIPTION

- A data logging subsystem shall be designed and developed for the Arbotix-M robocontroller
- Log files have to be stored on a microSD card
- At least 100ms resolution
- Choose the proper hardware elements, design the data structure

DATA LOGGING IN REAL-TIME SYSTEMS

- *The ability of the data logger system is that it can collect data in real-time after the logging subsystem is activated, then it will log all the information needed during the monitoring period.*
- What is data logging?
 - Process of collecting and recording data from sensor outputs automatically
- Logger element is needed
 - LVC125A chip based microSD card adaptor
- Must NOT disturb the observed system's behaviour

SYSTEM PLAN



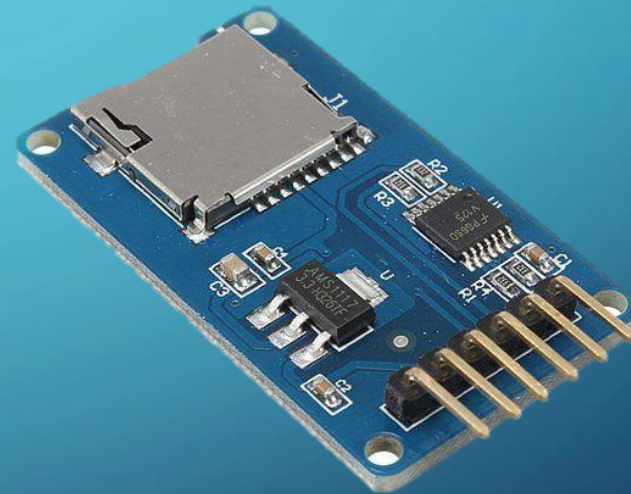
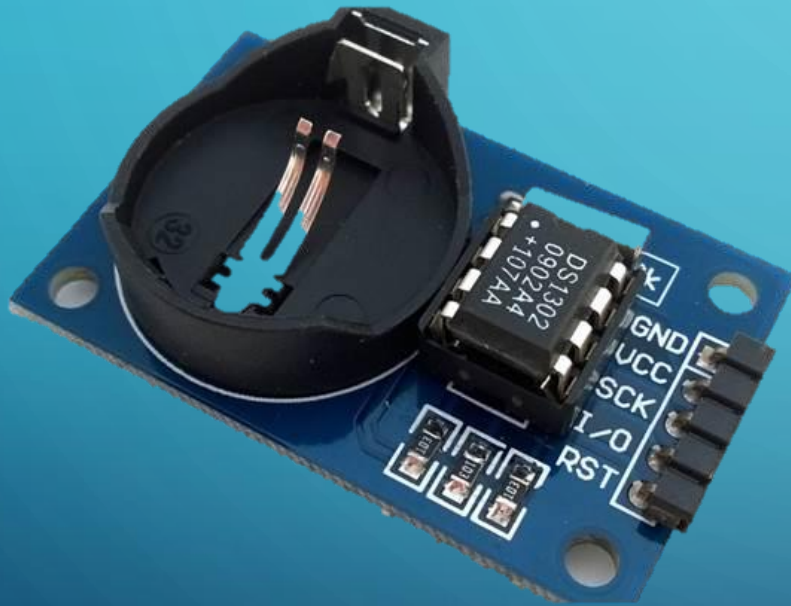
REQUIREMENTS

- System design and development has been driven by requirements
- I have defined two types of requirements:
 - System requirements
 - Software requirements
- System requirements contain hardware description and some mid level criteria
- Software requirements contain the description of SW functionalities and some non-functional details, e.g: Arduino IDE version

HARDWARE IMPLEMENTATION

- Arbotix-M Robocontroller has exactly the same input and output pins as and Arduino Uno microcontroller
- Pins used by the DS1302 module (left hand side is the microcontroller side):
 - Digital pin 2: RST
 - Digital pin 3: DAT
 - Digital pin 4: CLK
- Pins used by the microSD card shield:
 - Digital pin 10: CS
 - Digital pin 11: MOSI
 - Digital pin 12: MISO
 - Digital pin 13: SCK

USED HARDWARE ELEMENTS



LOGFILE STRUCTURE

- Timestamp needed but DS1302 has only seconds resolution
 - Solution is to log the loop count since the latest hard reset → `Millis()` function
- Voltage of the battery is monitored and logged
- Servo positions one by one
- .csv files are saved to the microSD card
 - They can be easily processed later and data visualisation is much more easier

SOFTWARE IMPLEMENTATION

- Component based development
- DS1302 and the microSD shield have their own basic functions
 - High level implementation was needed using the given functions
- RTC module: time and date setting, time and date reading
- microSD shield: secure file opening and closing, folder handling, reading from file and writing to file

SUMMARY

- Good basis has been created for the upcoming thesis
- Learnt two important and new devices not just for Arduino
- It was challenging to develop from a scratch, write the requirements and implement it
- Testing documentation has not been created as planned but unit tests have been executed

FUTURE PLANS

- With the help of the logging function a new movement replay function will be developed into the software
- A learning function is planned too when the servos release themselves and the user can record a series of movement by positioning the robotic arm manually
- Useful for industrial uses – much easier to record operations
- Useful for medical uses – rehabilitation exercises could be recorded and taught to patients

THANK YOU FOR YOUR ATTENTION!