Chaitanya Durgesh Nynavarapu
A20561894

ASSIGNMENT - 11
BIG DATA (CSP 554)

Initial Setup:

```
test> use assignment;
switched to db assignment
```

```
ssh.cloud.google.com/v2/ssh/projects/my-first-project-435417/zones/us-central1-b/instances/a20561894-n2-m?authuser=2&hl=en_US&projectNumber=734966278134&useAdminProxy=true - Google Chrome

ssh.cloud.google.com/v2/ssh/projects/my-first-project-435417/zones/us-central1-b/instances/a20561894-n2-m?authuser=2&hl=en_US&projectNumber=734966278134&useAdminProxy=true

SSH-in-browser                                          UPLOAD FILE    DOWNLOAD FILE

assignment> load('./load.js');
true
assignment> db.unicorns.find();
[
  {
    _id: ObjectId('673f6957b9f823e92fc1c18c'),
    name: 'Horny',
    dob: ISODate('1992-03-13T07:47:00.000Z'),
    loves: [ 'carrot', 'papaya' ],
    weight: 600,
    gender: 'm',
    vampires: 63
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c18d'),
    name: 'Aurora',
    dob: ISODate('1991-01-24T13:00:00.000Z'),
    loves: [ 'carrot', 'grape' ],
    weight: 450,
    gender: 'f',
    vampires: 43
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c18e'),
    name: 'Unicrom',
    dob: ISODate('1973-02-09T22:10:00.000Z'),
    loves: [ 'energon', 'redbull' ],
    weight: 984,
    gender: 'm',
    vampires: 182
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c18f'),
    name: 'Rooooodles',
    dob: ISODate('1979-08-18T18:44:00.000Z'),
    loves: [ 'apple' ],
    weight: 575,
    gender: 'm',
    vampires: 99
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c190'),
    name: 'Solnara',
    dob: ISODate('1985-07-04T02:01:00.000Z'),
    loves: [ 'apple', 'carrot', 'chocolate' ],
    weight: 550,
```

SSH-in-browser   ⬆ UPLOAD FILE   ⬇ DOWNLOAD FILE

```
  {
    _id: ObjectId('673f6957b9f823e92fc1c190'),
    name: 'Solnara',
    dob: ISODate('1985-07-04T02:01:00.000Z'),
    loves: [ 'apple', 'carrot', 'chocolate' ],
    weight: 550,
    gender: 'f',
    vampires: 80
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c191'),
    name: 'Ayna',
    dob: ISODate('1998-03-07T08:30:00.000Z'),
    loves: [ 'strawberry', 'lemon' ],
    weight: 733,
    gender: 'f',
    vampires: 40
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c192'),
    name: 'Kenny',
    dob: ISODate('1997-07-01T10:42:00.000Z'),
    loves: [ 'grape', 'lemon' ],
    weight: 690,
    gender: 'm',
    vampires: 39
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c193'),
    name: 'Raleigh',
    dob: ISODate('2005-05-03T00:57:00.000Z'),
    loves: [ 'apple', 'sugar' ],
    weight: 421,
    gender: 'm',
    vampires: 2
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c194'),
    name: 'Leia',
    dob: ISODate('2001-10-08T14:53:00.000Z'),
    loves: [ 'apple', 'watermelon' ],
    weight: 601,
    gender: 'f',
    vampires: 33
  },
  {
```

SSH-in-browser   ⬆ UPLOAD FILE   ⬇ DOWNLOAD FILE

```
  {
    _id: ObjectId('673f6957b9f823e92fc1c195'),
    name: 'Pilot',
    dob: ISODate('1997-03-01T05:03:00.000Z'),
    loves: [ 'apple', 'watermelon' ],
    weight: 650,
    gender: 'm',
    vampires: 54
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c196'),
    name: 'Nimue',
    dob: ISODate('1999-12-20T16:15:00.000Z'),
    loves: [ 'grape', 'carrot' ],
    weight: 540,
    gender: 'f'
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c197'),
    name: 'Dunx',
    dob: ISODate('1976-07-18T18:18:00.000Z'),
    loves: [ 'grape', 'watermelon' ],
    weight: 704,
    gender: 'm',
    vampires: 165
  }
]
assignment> load('./demo1.js');
true
assignment> db.unicorns.find();
[
  {
    _id: ObjectId('673f6957b9f823e92fc1c18c'),
    name: 'Horny',
    dob: ISODate('1992-03-13T07:47:00.000Z'),
    loves: [ 'carrot', 'papaya' ],
    weight: 600,
    gender: 'm',
    vampires: 63
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c18d'),
    name: 'Aurora',
    dob: ISODate('1991-01-24T13:00:00.000Z'),
    loves: [ 'carrot', 'grape' ],
    weight: 450,
```

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  {
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    gender: 'm',
    vampires: 182
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  {
    _id: ObjectId('673f6957b9f823e92fc1c18f'),
    name: 'Rooooooodles',
    dob: ISODate('1979-08-18T18:44:00.000Z'),
    loves: [ 'apple' ],
    weight: 575,
    gender: 'm',
    vampires: 99
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c190'),
    name: 'Solnara',
    dob: ISODate('1985-07-04T02:01:00.000Z'),
    loves: [ 'apple', 'carrot', 'chocolate' ],
    weight: 550,
    gender: 'f',
    vampires: 80
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    name: 'Ayna',
    dob: ISODate('1998-03-07T08:30:00.000Z'),
    loves: [ 'strawberry', 'lemon' ],
    weight: 733,
    gender: 'f',
    vampires: 40
  },
```

ssh.cloud.google.com/v2/ssh/projects/my-first-project-435417/zones/us-central1-b/instances/a20561894-n2-m?authuser=2&hl=en_US&projectNumber=734966278134&useAdminProxy=true - Google Chrome

ssh.cloud.google.com/v2/ssh/projects/my-first-project-435417/zones/us-central1-b/instances/a20561894-n2-m?authuser=2&hl=en_US&projectNumber=734966278134&useAdminProxy=true

SSH-in-browser   ⬆ UPLOAD FILE   ⬇ DOWNLOAD FILE

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    name: 'Kenny',
    dob: ISODate('1997-07-01T10:42:00.000Z'),
    loves: [ 'grape', 'lemon' ],
    weight: 690,
    gender: 'm',
    vampires: 39
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c193'),
    name: 'Raleigh',
    dob: ISODate('2005-05-03T00:57:00.000Z'),
    loves: [ 'apple', 'sugar' ],
    weight: 421,
    gender: 'm',
    vampires: 2
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c194'),
    name: 'Leia',
    dob: ISODate('2001-10-08T14:53:00.000Z'),
    loves: [ 'apple', 'watermelon' ],
    weight: 601,
    gender: 'f',
    vampires: 33
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c195'),
    name: 'Pilot',
    dob: ISODate('1997-03-01T05:03:00.000Z'),
    loves: [ 'apple', 'watermelon' ],
    weight: 650,
    gender: 'm',
    vampires: 54
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c196'),
    name: 'Nimue',
    dob: ISODate('1999-12-20T16:15:00.000Z'),
    loves: [ 'grape', 'carrot' ],
    weight: 540,
    gender: 'f'
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c197'),
```

```
  {
    _id: ObjectId('673f6957b9f823e92fc1c197'),
    name: 'Dunx',
    dob: ISODate('1976-07-18T18:18:00.000Z'),
    loves: [ 'grape', 'watermelon' ],
    weight: 704,
    gender: 'm',
    vampires: 165
  },
  {
    _id: ObjectId('673f6979b9f823e92fc1c198'),
    name: 'Leto',
    gender: 'm',
    home: 'Arrakeen',
    worm: false
  }
]
```

Exercise 1:

```
assignment> db.unicorns.find({ weight: { $lt: 500 } });
[
  {
    _id: ObjectId('673f6957b9f823e92fc1c18d'),
    name: 'Aurora',
    dob: ISODate('1991-01-24T13:00:00.000Z'),
    loves: [ 'carrot', 'grape' ],
    weight: 450,
    gender: 'f',
    vampires: 43
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c193'),
    name: 'Raleigh',
    dob: ISODate('2005-05-03T00:57:00.000Z'),
    loves: [ 'apple', 'sugar' ],
    weight: 421,
    gender: 'm',
    vampires: 2
  }
]
```

Exercise 2:


```
assignment> db.unicorns.find({ loves: "apple" });
[
  {
    _id: ObjectId('673f6957b9f823e92fc1c18f'),
    name: 'Rooooooodles',
    dob: ISODate('1979-08-18T18:44:00.000Z'),
    loves: [ 'apple' ],
    weight: 575,
    gender: 'm',
    vampires: 99
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c190'),
    name: 'Solnara',
    dob: ISODate('1985-07-04T02:01:00.000Z'),
    loves: [ 'apple', 'carrot', 'chocolate' ],
    weight: 550,
    gender: 'f',
    vampires: 80
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c193'),
    name: 'Raleigh',
    dob: ISODate('2005-05-03T00:57:00.000Z'),
    loves: [ 'apple', 'sugar' ],
    weight: 421,
    gender: 'm',
    vampires: 2
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c194'),
    name: 'Leia',
    dob: ISODate('2001-10-08T14:53:00.000Z'),
    loves: [ 'apple', 'watermelon' ],
    weight: 601,
    gender: 'f',
    vampires: 33
  },
  {
    _id: ObjectId('673f6957b9f823e92fc1c195'),
    name: 'Pilot',
    dob: ISODate('1997-03-01T05:03:00.000Z'),
    loves: [ 'apple', 'watermelon' ],
    weight: 650,
    gender: 'm',
    vampires: 54
  }
```

Exercise 3:

```
assignment> db.unicorns.insertOne({
...     name: "Malini",
...     dob: "2008-11-03",
...     loves: ["pears", "grapes"],
...     weight: 450,
...     gender: "F",
...     vampires: 23,
...     horns: 1
... });
{
  acknowledged: true,
  insertedId: ObjectId('673f6a9cb9f823e92fc1c199')
}
assignment> db.unicorns.find({ name: "Malini" });
[
  {
    _id: ObjectId('673f6a9cb9f823e92fc1c199'),
    name: 'Malini',
    dob: '2008-11-03',
    loves: [ 'pears', 'grapes' ],
    weight: 450,
    gender: 'F',
    vampires: 23,
    horns: 1
  }
]
```

Exercise 4:

```
assignment> db.unicorns.updateOne(
...     { name: "Malini" },
...     { $addToSet: { loves: "apricots" } }
... );
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
assignment> db.unicorns.find({ name: "Malini" });
[
  {
    _id: ObjectId('673f6a9cb9f823e92fc1c199'),
    name: 'Malini',
    dob: '2008-11-03',
    loves: [ 'pears', 'grapes', 'apricots' ],
    weight: 450,
    gender: 'F',
    vampires: 23,
    horns: 1
  }
]
```

Exercise 5:

```
assignment> db.unicorns.deleteMany({ weight: { $gt: 600 } });
{ acknowledged: true, deletedCount: 6 }
assignment> db.unicorns.find({ weight: { $gt: 600 } });

assignment> db.unicorns.find({ weight: { $gt: 600 } })
```

<u>**Exercise 6:**</u>

Modeling Temporal Aspects of Sensor Data for MongoDB NoSQL Database

Introduction

It is written by Mehmood et al. delves into the growing challenges of managing real-time, temporal data generated by sensors in the context of IoT. Traditional relational databases struggle with scaling and adapting to dynamic data structures, prompting a shift toward NoSQL solutions like MongoDB.

Research Focus

The study addresses how to design flexible schemas that can efficiently store and process sensor-generated temporal data in a document-oriented NoSQL database. This is particularly critical as IoT applications produce massive, continuous streams of timestamped data.

Core Questions and Hypotheses

The authors ask: *How can MongoDB be used to effectively manage real-time temporal data streams while retaining scalability and schema flexibility?* They hypothesize that MongoDB's inherent schema flexibility and hierarchical document model make it well-suited for this task.

Methodology

The paper proposes a middleware-based schema model tailored for MongoDB, specifically for managing temporal data from ANT+ sensors. By leveraging hierarchical JSON documents, the model accommodates schema evolution in real-time scenarios. The authors detail an algorithm designed to integrate incoming data streams dynamically, preserving both flexibility and efficiency.

Key Findings

The proposed solution successfully addresses the challenges of handling real-time, high-velocity data while maintaining seamless schema evolution. MongoDB's ability to store hierarchical data structures and scale horizontally proved advantageous for IoT applications. The middleware approach also optimized storage and query performance, making it viable for scenarios like healthcare monitoring systems.

Implications and Limitations

This study emphasizes MongoDB's potential to meet IoT demands, especially where temporal data and schema flexibility are critical. However, limitations in write-intensive scenarios and the lack of full ACID compliance highlight areas for improvement. The research underscores the importance of schema modeling in modern NoSQL environments to tackle the unique demands of IoT ecosystems.

Conclusion

By presenting a practical approach to temporal data modeling, the authors contribute to advancing data management strategies in IoT and big data. Their work bridges gaps in current technologies, offering valuable insights into building scalable, real-time data solutions.