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ФАКУЛЬТЕТ «Информатика и системы управления»

КАФЕДРА «Теоретическая информатика и компьютерные технологии»

Лабораторная работа № 4

по курсу «Разработка мобильных приложений»

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Москва 2025

1 Задача

Научиться создавать приложения с графическим пользовательским интерфейсом с использованием фреймворка Flutter на языке программирования Dart.

2 Практическая реализация

Код представлен в Листингах 1-2.

Листинг 1 - main.dart

```
import 'package:flutter/material.dart';
import 'package:http/http.dart' as http;
import 'dart:convert';
import 'dart:math' as math;
import 'package:shared_preferences/shared_preferences.dart';

void main() {
  runApp(const MyApp());
}

class MyApp extends StatelessWidget {
  const MyApp({super.key});
  @override
  Widget build(BuildContext context) {
    return MaterialApp(
      title: 'Lab     Widget Selector',
      theme: ThemeData(
        colorScheme: ColorScheme.fromSeed(seedColor: Colors.blue),
        useMaterial3: true,
      ),
      home: const WidgetSelectorPage(),
      debugShowCheckedModeBanner: false,
    );
  }
}

class WidgetSelectorPage extends StatelessWidget {
  const WidgetSelectorPage({super.key});

  void _open(BuildContext context, Widget page) {
    Navigator.of(context).push(MaterialPageRoute(builder: (_) => page));
  }

  @override
  Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(title: const Text('                    ')),
      body: ListView(
        children: [
          ListTile(
              title: const Text('   1   '),
              subtitle: const Text(''),
              trailing: const Icon(Icons.chevron_right),
              onTap: () => _open(context, const Lab1Page()),
            ),
            const Divider(height: 1),

            //                :                  3

            ListTile(
              title: const Text('   2   '),
              subtitle: const Text(''),
              trailing: const Icon(Icons.chevron_right),
              onTap: () => _open(context, const Lab2WheelControlPage()),
            ),
            const Divider(height: 1),

            //                           :     4     ->     4
            ListTile(
              title: const Text('   4                      '),
              subtitle: const Text(''),
              trailing: const Icon(Icons.chevron_right),
              onTap: () => _open(context, const Lab4Page()),
            ),
            const Divider(height: 1),

            //                     :     4           (                  )
            ListTile(
              title: const Text('   4              '),
              subtitle: const Text(''),
              trailing: const Icon(Icons.chevron_right),
              onTap: () => _open(context, const Lab4DemoPage()),
            ),
            const Divider(height: 1),
          ],
        ),
      );
  }
}

class Lab1Page extends StatefulWidget {
  const Lab1Page({super.key});

  @override
  State<Lab1Page> createState() => _Lab1PageState();
}
```

```
class _Lab1PageState extends State<Lab1Page> {
  int _counter = 0;

  void _incrementCounter() {
    setState(() => _counter++);
  }

  @override
  Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(title: const Text('Lab1    Flutter Counter')),
      body: Center(
        child: Column(
          mainAxisAlignment: MainAxisAlignment.center,
          children: <Widget>[
            const Text('You have pushed the button this many times:'),
            Text(
              '$_counter',
              style: Theme.of(context).textTheme.headlineMedium,
            ),
          ],
        ),
      ),
      floatingActionButton: FloatingActionButton(
        onPressed: _incrementCounter,
        tooltip: 'Increment',
        child: const Icon(Icons.add),
      ),
    );
  }
}

class Lab2WheelControlPage extends StatefulWidget {
  const Lab2WheelControlPage({super.key});

  @override
  State<Lab2WheelControlPage> createState() => _Lab2WheelControlPageState();
}

class _Lab2WheelControlPageState extends State<Lab2WheelControlPage> {
  int _leftValue = 0;
  int _rightValue = 0;
  bool _serviceEnabled = true;
  bool _isLoading = false;
  String _lastUpdate = '';
```

```dart
String _directionStatus = '';

@override
void initState() {
  super.initState();
  _checkServiceStatus();
}

void _checkServiceStatus() async {
  try {
    final uri =
        Uri.parse('http://iocontrol.ru/api/readData/BoardVenya2/TestVar2');
    final response = await http.get(uri);
    if (response.statusCode == 200) {
      final jsonResponse = json.decode(response.body);
      final bool check = jsonResponse['check'] ?? false;

      if (check) {
        final statusValue = jsonResponse['value'] ?? "0";
        setState(() {
          _serviceEnabled = statusValue == "1";
        });

        if (_serviceEnabled) {
          _loadWheelsValues();
        }
      }
    }
  } catch (error) {
    debugPrint("Error checking service status: $error");
  }
}

void _loadWheelsValues() async {
  setState(() => _isLoading = true);
  try {
    // left
    final leftUri =
        Uri.parse('http://iocontrol.ru/api/readData/BoardVenya2/left');
    final leftResponse = await http.get(leftUri);
    if (leftResponse.statusCode == 200) {
      final jsonResponse = json.decode(leftResponse.body);
      final bool check = jsonResponse['check'] ?? false;
      if (check) {
        final leftValue = int.tryParse(jsonResponse['value'] ?? '0') ?? 0;
        setState(() => _leftValue = leftValue);
        }
      }

      // right
      final rightUri =
          Uri.parse('http://iocontrol.ru/api/readData/BoardVenya2/right');
      final rightResponse = await http.get(rightUri);
      if (rightResponse.statusCode == 200) {
        final jsonResponse = json.decode(rightResponse.body);
        final bool check = jsonResponse['check'] ?? false;
        if (check) {
          final rightValue = int.tryParse(jsonResponse['value'] ?? '0') ?? 0;
          setState(() => _rightValue = rightValue);
        }
      }
    } catch (error) {
      debugPrint("Error loading wheels values: $error");
    } finally {
      setState(() => _isLoading = false);
    }
  }

  void _incrementLeft() {
    if (!_serviceEnabled) return;
    setState(() => _leftValue++);
    _updateValuesOnServer();
  }

  void _decrementLeft() {
    if (!_serviceEnabled) return;
    setState(() => _leftValue--);
    _updateValuesOnServer();
  }

  void _incrementRight() {
    if (!_serviceEnabled) return;
    setState(() => _rightValue++);
    _updateValuesOnServer();
  }

  void _decrementRight() {
    if (!_serviceEnabled) return;
    setState(() => _rightValue--);
    _updateValuesOnServer();
  }
```

```
void _resetValues() {
  if (!_serviceEnabled) return;
  setState(() {
    _leftValue = 0;
    _rightValue = 0;
    _directionStatus = '';
  });
  _updateValuesOnServer();
}

void _updateValuesOnServer() async {
  try {
    final leftUri = Uri.parse(
        'http://iocontrol.ru/api/sendData/BoardVenya2/left/$_leftValue');
    final rightUri = Uri.parse(
        'http://iocontrol.ru/api/sendData/BoardVenya2/right/$_rightValue');

    final leftResponse = await http.get(leftUri);
    final rightResponse = await http.get(rightUri);

    if (leftResponse.statusCode == 200 && rightResponse.statusCode == 200)
       {
      setState(() => _lastUpdate = DateTime.now().toString());
    }
  } catch (error) {
    debugPrint("Error updating values: $error");
  }
}

void _getDeviceStatus() {
  if (!_serviceEnabled) return;
  setState(() {
    if (_rightValue > _leftValue) {
      _directionStatus = '                              ';
    } else if (_leftValue > _rightValue) {
      _directionStatus = '                                ';
    } else if (_leftValue == _rightValue && _leftValue == 0) {
      _directionStatus = '                                         ';
    } else {
      _directionStatus = '                                ';
    }
  });
}

void _getBitovkaLampRequestON() {
  setState(() => _isLoading = true);
```

```
    final uri =
        Uri.parse('http://iocontrol.ru/api/sendData/BoardVenya2/TestVar2/1');
    http.get(uri).then((response) {
      setState(() => _serviceEnabled = true);
      _loadWheelsValues();
    }).catchError((error) {
      setState(() => _isLoading = false);
      debugPrint("Error turning on service: $error");
    });
  }

  void _getBitovkaLampRequestOFF() {
    setState(() => _isLoading = true);
    final uri =
        Uri.parse('http://iocontrol.ru/api/sendData/BoardVenya2/TestVar2/0');
    http.get(uri).then((response) {
      setState(() {
        _serviceEnabled = false;
        _isLoading = false;
      });
    }).catchError((error) {
      setState(() => _isLoading = false);
      debugPrint("Error turning off service: $error");
    });
  }

  @override
  Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(
        title: const Text('Lab2   Wheel Control'),
        actions: [
          IconButton(
            icon: const Icon(Icons.refresh),
            onPressed: _serviceEnabled ? _loadWheelsValues : null,
            tooltip: 'Refresh values',
          ),
        ],
      ),
      body: Center(
        child: _isLoading
            ? const Column(
                mainAxisAlignment: MainAxisAlignment.center,
                children: [
                  CircularProgressIndicator(),
                  SizedBox(height: 20),
                  Text('Loading...'),
                ],
              )
            : SingleChildScrollView(
                padding: const EdgeInsets.all(16.0),
                child: Column(
                  mainAxisAlignment: MainAxisAlignment.center,
                  children: <Widget>[
                    // Service Status
                    Card(
                      elevation: 4,
                      child: Padding(
                        padding: const EdgeInsets.all(16.0),
                        child: Column(
                          children: [
                            Text('Service Status:',
                                style:
                                    Theme.of(context).textTheme.titleMedium),
                            const SizedBox(height: 8),
                            Text(
                              _serviceEnabled ? 'ENABLED' : 'DISABLED',
                              style: TextStyle(
                                color:
                                    _serviceEnabled ? Colors.green : Colors.
                                        red,
                                fontWeight: FontWeight.bold,
                                fontSize: 20,
                              ),
                            ),
                          ],
                        ),
                      ),
                    ),

                    const SizedBox(height: 20),

                    // Left Wheel
                    Card(
                      elevation: 4,
                      child: Padding(
                        padding: const EdgeInsets.all(16.0),
                        child: Column(
                          children: [
                            Text('Left Wheel:',
                                style:
                                    Theme.of(context).textTheme.titleMedium),
                      const SizedBox(height: 8),
                      Text('$_leftValue',
                          style: const TextStyle(
                            fontSize: 32,
                            fontWeight: FontWeight.bold,
                          )),
                      const SizedBox(height: 12),
                      Row(
                        mainAxisAlignment: MainAxisAlignment.center,
                        children: [
                          ElevatedButton(
                            style: ElevatedButton.styleFrom(
                              backgroundColor: Colors.red,
                              foregroundColor: Colors.white,
                              minimumSize: const Size(60, 60),
                              shape: const CircleBorder(),
                            ),
                            onPressed:
                                _serviceEnabled ? _decrementLeft : null
                                    ,
                            child: const Icon(Icons.remove, size: 30),
                          ),
                          const SizedBox(width: 20),
                          ElevatedButton(
                            style: ElevatedButton.styleFrom(
                              backgroundColor: Colors.green,
                              foregroundColor: Colors.white,
                              minimumSize: const Size(60, 60),
                              shape: const CircleBorder(),
                            ),
                            onPressed:
                                _serviceEnabled ? _incrementLeft : null
                                    ,
                            child: const Icon(Icons.add, size: 30),
                          ),
                        ],
                      ),
                    ],
                  ),
                ),
              ),

              const SizedBox(height: 20),

              // Right Wheel
              Card(
elevation: 4,
child: Padding(
  padding: const EdgeInsets.all(16.0),
  child: Column(
    children: [
      Text('Right Wheel:',
          style:
              Theme.of(context).textTheme.titleMedium),
      const SizedBox(height: 8),
      Text('$_rightValue',
          style: const TextStyle(
            fontSize: 32,
            fontWeight: FontWeight.bold,
          )),
      const SizedBox(height: 12),
      Row(
        mainAxisAlignment: MainAxisAlignment.center,
        children: [
          ElevatedButton(
            style: ElevatedButton.styleFrom(
              backgroundColor: Colors.red,
              foregroundColor: Colors.white,
              minimumSize: const Size(60, 60),
              shape: const CircleBorder(),
            ),
            onPressed:
                _serviceEnabled ? _decrementRight :
                    null,
            child: const Icon(Icons.remove, size: 30),
          ),
          const SizedBox(width: 20),
          ElevatedButton(
            style: ElevatedButton.styleFrom(
              backgroundColor: Colors.green,
              foregroundColor: Colors.white,
              minimumSize: const Size(60, 60),
              shape: const CircleBorder(),
            ),
            onPressed:
                _serviceEnabled ? _incrementRight :
                    null,
            child: const Icon(Icons.add, size: 30),
          ),
        ],
      ),
    ],
        ),
      ),
    ),

    const SizedBox(height: 20),

    // Device Status
    Card(
      elevation: 4,
      child: Padding(
        padding: const EdgeInsets.all(16.0),
        child: Column(
          children: [
            Text('Device Status:',
                style:
                    Theme.of(context).textTheme.titleMedium),
            const SizedBox(height: 8),
            Text(
              _directionStatus.isEmpty
                  ? 'Press "Get Status" to check'
                  : _directionStatus,
              style: TextStyle(
                color: _directionStatus.isEmpty
                    ? Colors.grey
                    : Colors.blue,
                fontWeight: FontWeight.bold,
                fontSize: 18,
              ),
            ),
            const SizedBox(height: 12),
            ElevatedButton(
              style: ElevatedButton.styleFrom(
                backgroundColor: Colors.purple,
                foregroundColor: Colors.white,
                minimumSize: const Size(200, 50),
              ),
              onPressed:
                  _serviceEnabled ? _getDeviceStatus : null,
              child: const Text('GET DEVICE STATUS'),
            ),
          ],
        ),
      ),
    ),

    const SizedBox(height: 20),
Row(
  mainAxisAlignment: MainAxisAlignment.center,
  children: [
    ElevatedButton(
      style: ElevatedButton.styleFrom(
        backgroundColor: Colors.blue,
        foregroundColor: Colors.white,
      ),
      onPressed: _getBitovkaLampRequestON,
      child: const Text('TURN ON SERVICE'),
    ),
    const SizedBox(width: 10),
    ElevatedButton(
      style: ElevatedButton.styleFrom(
        backgroundColor: Colors.grey,
        foregroundColor: Colors.white,
      ),
      onPressed: _getBitovkaLampRequestOFF,
      child: const Text('TURN OFF SERVICE'),
    ),
  ],
),

const SizedBox(height: 20),

ElevatedButton(
  style: ElevatedButton.styleFrom(
    backgroundColor: Colors.orange,
    foregroundColor: Colors.white,
    minimumSize: const Size(200, 50),
  ),
  onPressed: _serviceEnabled ? _resetValues : null,
  child: const Text('RESET VALUES TO 0'),
),

const SizedBox(height: 10),
Text(
  'Range: -100 to 100',
  style: TextStyle(
    color: Colors.grey[600],
    fontStyle: FontStyle.italic,
  ),
),

if (_lastUpdate.isNotEmpty) ...[
  const SizedBox(height: 10),
                      Text(
                        'Last update: $_lastUpdate',
                        style: TextStyle(
                          color: Colors.grey[600],
                          fontSize: 12,
                        ),
                      ),
                    ],
                  ],
                ),
              ),
      ),
    );
  }
}

class EmptyPage extends StatelessWidget {
  final String title;
  final String subtitle;
  const EmptyPage({super.key, required this.title, required this.subtitle});

  @override
  Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(title: Text('$title               ')),
      body: Center(
        child: Column(
          mainAxisAlignment: MainAxisAlignment.center,
          children: [
            const Icon(Icons.info_outline, size: 64),
            const SizedBox(height: 12),
            Text(
              subtitle,
              textAlign: TextAlign.center,
              style: Theme.of(context).textTheme.titleMedium,
            ),
          ],
        ),
      ),
    );
  }
}

class Lab4Page extends StatefulWidget {
  const Lab4Page({super.key});
  @override
  State<Lab4Page> createState() => _Lab4PageState();
}

class _Lab4PageState extends State<Lab4Page> {
  static const double minLen = 10;
  static const double maxLen = 200;

  static const _kA = 'lab4_a';
  static const _kB = 'lab4_b';
  static const _kC = 'lab4_c';
  static const _kHidden = 'lab4_showHidden';

  double a = 120;
  double b = 80;
  double c = 100;
  bool showHidden = true;

  @override
  void initState() {
    super.initState();
    _loadSettings();
  }

  Future<void> _loadSettings() async {
    final sp = await SharedPreferences.getInstance();
    setState(() {
      a = sp.getDouble(_kA) ?? 120;
      b = sp.getDouble(_kB) ?? 80;
      c = sp.getDouble(_kC) ?? 100;
      showHidden = sp.getBool(_kHidden) ?? true;
    });
  }

  Future<void> _saveSettings() async {
    final sp = await SharedPreferences.getInstance();
    await sp.setDouble(_kA, a);
    await sp.setDouble(_kB, b);
    await sp.setDouble(_kC, c);
    await sp.setBool(_kHidden, showHidden);
  }

  @override
  void dispose() {
    _saveSettings();
    super.dispose();
```

```
}

@override
Widget build(BuildContext context) {
  return Scaffold(
    //
    appBar: AppBar(title: const Text('    4                    ')),
    body: Column(
      children: [
        Card(
          margin: const EdgeInsets.all(12),
          child: Padding(
            padding: const EdgeInsets.symmetric(horizontal: 12, vertical:
                8),
            child: Column(
              mainAxisSize: MainAxisSize.min,
              children: [
                _lenSlider(
                  label: 'a',
                  value: a,
                  onChanged: (v) => setState(() { a = v; }),
                  onChangeEnd: (_) => _saveSettings(),
                ),
                _lenSlider(
                  label: 'b',
                  value: b,
                  onChanged: (v) => setState(() { b = v; }),
                  onChangeEnd: (_) => _saveSettings(),
                ),
                _lenSlider(
                  label: 'c',
                  value: c,
                  onChanged: (v) => setState(() { c = v; }),
                  onChangeEnd: (_) => _saveSettings(),
                ),
                const SizedBox(height: 4),
                Row(
                  children: [
                    FilterChip(
                      label: const Text('
                                                        '),
                      selected: showHidden,
                      onSelected: (v) {
                        setState(() => showHidden = v);
                        _saveSettings();
                      },
                    ),
                    const Spacer(),
                    TextButton.icon(
                      onPressed: () {
                        setState(() {
                          a = 120; b = 80; c = 100; showHidden = true;
                        });
                        _saveSettings();
                      },
                      icon: const Icon(Icons.restart_alt),
                      label: const Text('          '),
                    ),
                  ],
                ),
              ],
            ),
          ),
        ),
        Expanded(
          child: Center(
            child: AspectRatio(
              aspectRatio: 1.2,
              child: Card(
                margin: const EdgeInsets.all(12),
                child: Padding(
                  padding: const EdgeInsets.all(8.0),
                  child: CustomPaint(
                    painter: IsoParallelepipedPainter(
                      a,
                      b,
                      c,
                      showHidden: showHidden,
                    ),
                    willChange: true,
                  ),
                ),
              ),
            ),
          ),
        ),
      ],
    ),
  );
}

Widget _lenSlider({
    required String label,
    required double value,
    required ValueChanged<double> onChanged,
    ValueChanged<double>? onChangeEnd,
  }) {
    const double minLen = _Lab4PageState.minLen;
    const double maxLen = _Lab4PageState.maxLen;

    return Column(
      crossAxisAlignment: CrossAxisAlignment.start,
      children: [
        Row(
          children: [
            Text('$label:', style: const TextStyle(fontWeight: FontWeight.
                w600)),
            const SizedBox(width: 8),
            Text(value.toStringAsFixed(0)),
            const Spacer(),
            Text('${minLen.toStringAsFixed(0)}     ${maxLen.toStringAsFixed
                (0)}'),
          ],
        ),
        Slider.adaptive(
          value: value.clamp(minLen, maxLen).toDouble(),
          min: minLen,
          max: maxLen,
          divisions: (maxLen - minLen).toInt(),
          label: value.toStringAsFixed(0),
          onChanged: onChanged,
          onChangeEnd: onChangeEnd,
        ),
        const SizedBox(height: 4),
      ],
    );
  }
}

class IsoParallelepipedPainter extends CustomPainter {
  final double a, b, c;
  final bool showHidden;

  IsoParallelepipedPainter(this.a, this.b, this.c, {required this.showHidden
      });

  static const double _cos30 = 0.8660254037844386;
  static const double _sin30 = 0.5;
```

```
Offset _iso(double x, double y, double z) {
  final sx = (x - y) * _cos30;
  final sy = (x + y) * _sin30 - z;
  return Offset(sx, sy);
}

List<(String, String)> get _edges => const [
      // X-
      ('000', '100'),
      ('010', '110'),
      ('001', '101'),
      ('011', '111'),
      // Y-
      ('000', '010'),
      ('100', '110'),
      ('001', '011'),
      ('101', '111'),
      // Z-
      ('000', '001'),
      ('100', '101'),
      ('010', '011'),
      ('110', '111'),
    ];

Set<(String, String)> get _visibleEdges {
  final s = <(String, String)>{};

  void addFaceEdges(List<String> vs) {
    final e = <(String, String)>[
      (vs[0], vs[1]),
      (vs[1], vs[3]),
      (vs[3], vs[2]),
      (vs[2], vs[0]),
    ];
    for (final edge in e) {
      final sorted = _sortEdge(edge);
      s.add(sorted);
    }
  }

  addFaceEdges(['000', '100', '001', '101']); // y = 0 (                )
  addFaceEdges(['100', '110', '101', '111']); // x = a (            )
  addFaceEdges(['001', '101', '011', '111']); // z = c (              )

  return s;
```

```
}

(String, String) _sortEdge((String, String) e) {
  final a = e.$1;
  final b = e.$2;
  return (a.compareTo(b) <= 0) ? (a, b) : (b, a);
}

@override
void paint(Canvas canvas, Size size) {
  if (a <= 0 || b <= 0 || c <= 0) {
    _drawCenteredText(canvas, size, '                                  > 0')
        ;
    return;
  }

  final Map<String, Offset> p2d = {};

  const margin = 24.0;
  final w = size.width - 2 * margin;
  final h = size.height - 2 * margin;

  final pts = <Offset>[
    _iso(0, 0, 0),
    _iso(a, 0, 0),
    _iso(0, b, 0),
    _iso(a, b, 0),
    _iso(0, 0, c),
    _iso(a, 0, c),
    _iso(0, b, c),
    _iso(a, b, c),
  ];

  final bounds = _pointsBounds(pts);
  final sx = w / bounds.width;
  final sy = h / bounds.height;
  final scale = 0.9 * math.min(sx, sy);

  final center = Offset(size.width / 2, size.height / 2);
  final geoCenter = Offset(bounds.left + bounds.width / 2, bounds.top +
      bounds.height / 2);

  void put(String key, double x, double y, double z) {
    final p = _iso(x, y, z);
    final q = (p - geoCenter) * scale + center;
    p2d[key] = q;
```

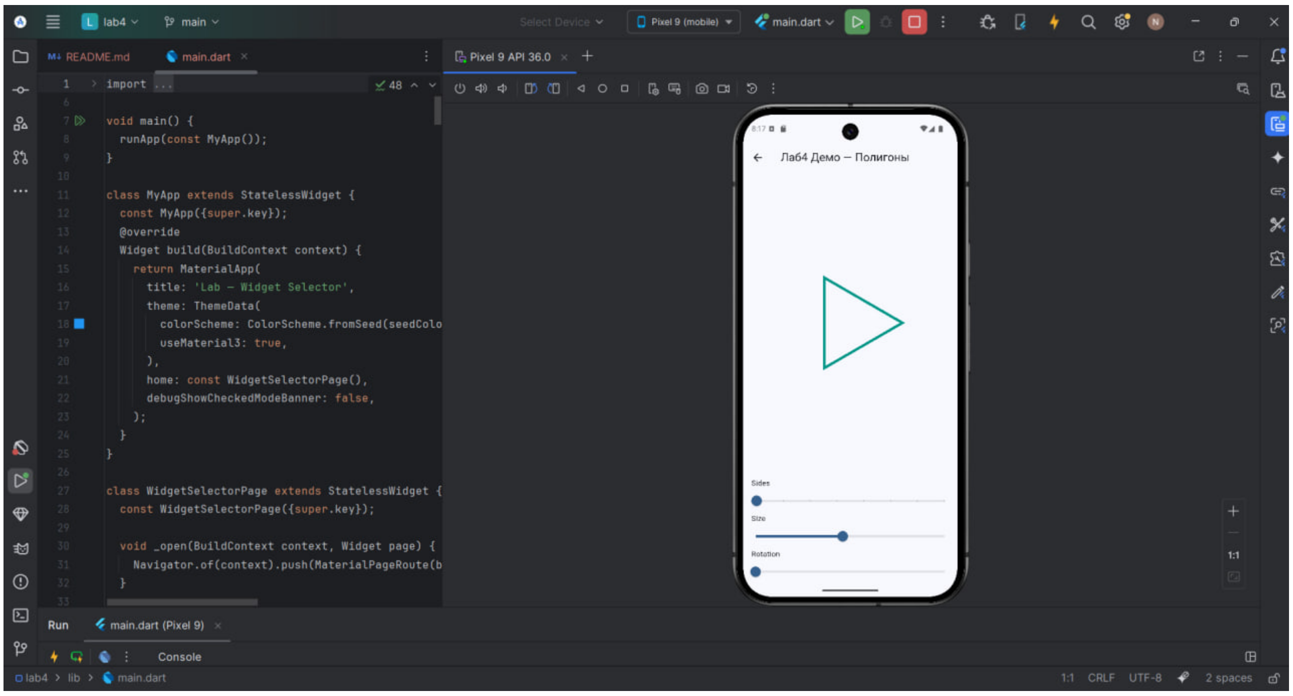
```
}

// 8
put('000', 0, 0, 0);
put('100', a, 0, 0);
put('010', 0, b, 0);
put('110', a, b, 0);
put('001', 0, 0, c);
put('101', a, 0, c);
put('011', 0, b, c);
put('111', a, b, c);

Offset? v(String k) => p2d[k];

final paintSolid = Paint()
  ..style = PaintingStyle.stroke
  ..strokeWidth = 2.0
  ..color = Colors.black;

final paintHidden = Paint()
  ..style = PaintingStyle.stroke
  ..strokeWidth = 1.5
  ..color = Colors.grey;

final paintFill = Paint()
  ..style = PaintingStyle.fill
  ..color = const Color(0x99FFFFFF); //


final visible = _visibleEdges;
final all = _edges.map(_sortEdge).toSet();
final hidden = all.difference(visible);

if (showHidden) {
  for (final e in hidden) {
    final p1 = v(e.$1), p2 = v(e.$2);
    if (p1 != null && p2 != null) {
      _drawDashedLine(canvas, p1, p2, paintHidden, dash: 8, gap: 6);
    }
  }
}

Path face(List<String> vs) {
  final a = v(vs[0]), b = v(vs[1]), d = v(vs[3]), c = v(vs[2]);
  final path = Path();
  if (a == null || b == null || c == null || d == null) return path;
```

```
      path..moveTo(a.dx, a.dy)..lineTo(b.dx, b.dy)..lineTo(d.dx, d.dy)..
          lineTo(c.dx, c.dy)..close();
      return path;
    }

    for (final f in [
      ['000', '100', '001', '101'], // y=0
      ['100', '110', '101', '111'], // x=a
      ['001', '101', '011', '111'], // z=c
    ]) {
      final path = face(f);
      if (path.computeMetrics().isNotEmpty) {
        canvas.drawPath(path, paintFill);
      }
    }

    for (final e in visible) {
      final p1 = v(e.$1), p2 = v(e.$2);
      if (p1 != null && p2 != null) {
        canvas.drawLine(p1, p2, paintSolid);
      }
    }
  }

  @override
  bool shouldRepaint(covariant IsoParallelepipedPainter old) {
    return a != old.a || b != old.b || c != old.c || showHidden != old.
        showHidden;
  }

  Rect _pointsBounds(List<Offset> pts) {
    double minX = double.infinity, minY = double.infinity;
    double maxX = -double.infinity, maxY = -double.infinity;
    for (final p in pts) {
      if (p.dx < minX) minX = p.dx;
      if (p.dy < minY) minY = p.dy;
      if (p.dx > maxX) maxX = p.dx;
      if (p.dy > maxY) maxY = p.dy;
    }
    return Rect.fromLTRB(minX, minY, maxX, maxY);
  }

  void _drawDashedLine(Canvas canvas, Offset a, Offset b, Paint paint,
      {double dash = 6, double gap = 4}) {
    final total = (b - a).distance;
    final dir = (b - a) / total;
    double t = 0;
    while (t < total) {
      final tNext = math.min(t + dash, total);
      final p1 = a + dir * t;
      final p2 = a + dir * tNext;
      canvas.drawLine(p1, p2, paint);
      t = tNext + gap;
    }
  }

  void _drawCenteredText(Canvas canvas, Size size, String text) {
    final tp = TextPainter(
      text: const TextSpan(
        text: '                                > 0',
        style: TextStyle(fontSize: 16, color: Colors.grey),
      ),
      textDirection: TextDirection.ltr,
    )..layout(maxWidth: size.width - 40);
    final pos = Offset(
      (size.width - tp.width) / 2,
      (size.height - tp.height) / 2,
    );
    tp.paint(canvas, pos);
  }
}

class Lab4DemoPage extends StatefulWidget {
  const Lab4DemoPage({super.key});

  @override
  State<Lab4DemoPage> createState() => _Lab4DemoPageState();
}

class _Lab4DemoPageState extends State<Lab4DemoPage> {
  double _sides = 3.0;
  double _radius = 100.0;
  double _radians = 0.0;
  static const _kSides   = 'lab4demo_sides';
  static const _kRadius  = 'lab4demo_radius';
  static const _kRadians = 'lab4demo_radians';

  @override
  void initState() {
    super.initState();
    _loadDemoPrefs();
  }
```

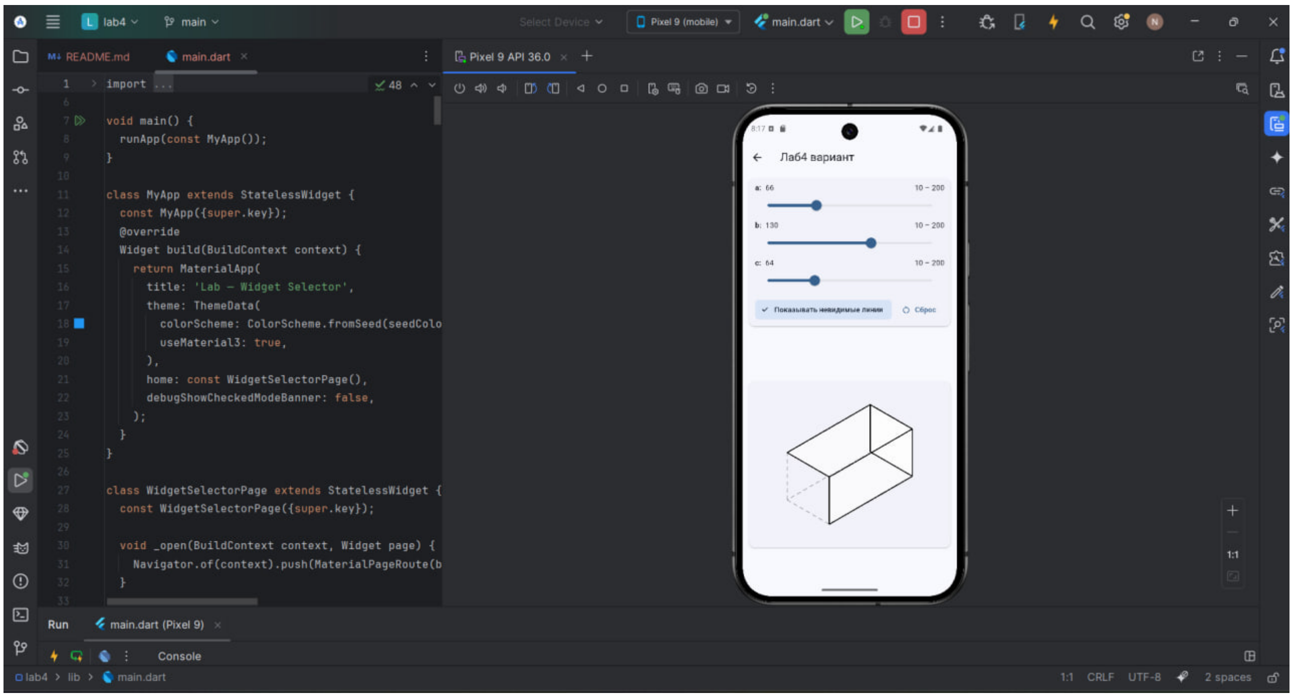
```
Future<void> _loadDemoPrefs() async {
  final sp = await SharedPreferences.getInstance();
  setState(() {
    _sides   = sp.getDouble(_kSides)   ?? 3.0;
    _radius  = sp.getDouble(_kRadius)  ?? 100.0;
    _radians = sp.getDouble(_kRadians) ?? 0.0;
  });
}

Future<void> _saveDemoPrefs() async {
  final sp = await SharedPreferences.getInstance();
  await sp.setDouble(_kSides, _sides);
  await sp.setDouble(_kRadius, _radius);
  await sp.setDouble(_kRadians, _radians);
}

@override
void dispose() {
  _saveDemoPrefs();
  super.dispose();
}

@override
Widget build(BuildContext context) {
  final maxR = MediaQuery.of(context).size.width / 2;

  return Scaffold(
    appBar: AppBar(
      title: const Text('   4                              '),
    ),
    body: SafeArea(
      child: Column(
        crossAxisAlignment: CrossAxisAlignment.start,
        children: <Widget>[
          Expanded(
            child: CustomPaint(
              painter: ShapePainter(_sides, _radius, _radians),
              child: const SizedBox.expand(),
            ),
          ),
          const Padding(
            padding: EdgeInsets.only(left: 16.0, top: 8),
            child: Text('Sides'),
          ),
          // Sides
```

```
              Slider(
                value: _sides,
                min: 3.0,
                max: 10.0,
                label: _sides.toInt().toString(),
                divisions: 7,
                onChanged: (value) => setState(() => _sides = value),
                onChangeEnd: (_) => _saveDemoPrefs(),
              ),
              Padding(
                padding: const EdgeInsets.only(left: 16.0),
                child: Text('Size'),
              ),
              // Size
              Slider(
                value: _radius.clamp(10.0, maxR),
                min: 10.0,
                max: maxR,
                onChanged: (value) => setState(() => _radius = value),
                onChangeEnd: (_) => _saveDemoPrefs(),
              ),
              Padding(
                padding: const EdgeInsets.only(left: 16.0),
                child: Text('Rotation'),
              ),
              // Rotation
              Slider(
                value: _radians,
                min: 0.0,
                max: math.pi,
                onChanged: (value) => setState(() => _radians = value),
                onChangeEnd: (_) => _saveDemoPrefs(),
              ),

            ],
          ),
        ),
      );
  }
}

// Painter
class ShapePainter extends CustomPainter {
  final double sides;
  final double radius;
  final double radians;
  ShapePainter(this.sides, this.radius, this.radians);

  @override
  void paint(Canvas canvas, Size size) {
      final paint = Paint()
        ..color = Colors.teal
        ..strokeWidth = 5
        ..style = PaintingStyle.stroke
        ..strokeCap = StrokeCap.round;

      final path = Path();
      final angle = (math.pi * 2) / sides;

      final center = Offset(size.width / 2, size.height / 2);
      final startPoint = Offset(
        radius * math.cos(radians),
        radius * math.sin(radians),
      );

      path.moveTo(startPoint.dx + center.dx, startPoint.dy + center.dy);

      for (int i = 1; i <= sides; i++) {
        final x = radius * math.cos(radians + angle * i) + center.dx;
        final y = radius * math.sin(radians + angle * i) + center.dy;
        path.lineTo(x, y);
      }
      path.close();
      canvas.drawPath(path, paint);
  }

  @override
  bool shouldRepaint(covariant CustomPainter oldDelegate) => true;
}
```

В результате работы программы получился следующий вывод:



```
import ...

void main() {
  runApp(const MyApp());
}

class MyApp extends StatelessWidget {
  const MyApp({super.key});
  @override
  Widget build(BuildContext context) {
    return MaterialApp(
      title: 'Lab – Widget Selector',
      theme: ThemeData(
        colorScheme: ColorScheme.fromSeed(seedColo
        useMaterial3: true,
      ),
      home: const WidgetSelectorPage(),
      debugShowCheckedModeBanner: false,
    );
  }
}

class WidgetSelectorPage extends StatelessWidget {
  const WidgetSelectorPage({super.key});

  void _open(BuildContext context, Widget page) {
    Navigator.of(context).push(MaterialPageRoute(b
  }
```



```
import ...

void main() {
  runApp(const MyApp());
}

class MyApp extends StatelessWidget {
  const MyApp({super.key});
  @override
  Widget build(BuildContext context) {
    return MaterialApp(
      title: 'Lab – Widget Selector',
      theme: ThemeData(
        colorScheme: ColorScheme.fromSeed(seedColo
        useMaterial3: true,
      ),
      home: const WidgetSelectorPage(),
      debugShowCheckedModeBanner: false,
    );
  }
}

class WidgetSelectorPage extends StatelessWidget {
  const WidgetSelectorPage({super.key});

  void _open(BuildContext context, Widget page) {
    Navigator.of(context).push(MaterialPageRoute(b
  }
```

3 Заключение

В ходе лабораторной работы удалось поработать с графикой в Flutter