RATHINAM TECHNICAL CAMPUS

RATHINAM TECHZONE

POLLACHI MAIN ROAD, EACHANARI, COIMBATORE-641021.

MASTER OF COMPUTER APPLICATION

RECORD NOTE BOOK

23MCP11 EMBEDDED LINUX PORTING WITH YOCTO LABORATORY

NAME :

REGISTER NUMBER :

YEAR/SEMESTER :

ACADEMIC YEAR :

RATHINAM TECHNICAL CAMPUS

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BONAFIDE CERTIFICATE

NAME :

ACADEMIC YEAR :

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UNIVERSITY REGISTER NUMBER: …….

Certified that this is the bonafide record of work done by the above student in the

_____Laboratory during the year 2024-2025.

Head of the Department **Staff-in-Charge**

Submitted for the Practical Examination held on _____

Internal Examiner **External Examiner**

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EX NO: 01 DATE:	**Define a simple recipe for a "Hello World" application. Understand the concept of Yocto layers and workflow. Use .bbappend files to modify existing recipes.**

AIM:

To create a simple recipe for a "Hello World" application.

ALGORITHM:

STEP 1: Start the process.

user :~$ docker pull ubuntu:16.04

user :~$ docker run -it ubuntu:16.04

root@584a332c0218:/# apt-get update

STEP 2: Pull and run an Ubuntu container.

STEP 3: Install the packages needed for yocto.

root@13f28da9360f:/home# cd yocto/

root@13f28da9360f:/home/yocto# cd sources/

STEP 4: Create a recipe directory in meta-rba5d2x (ex:recipe-hello).

root@13f28da9360f:/home/yocto/sources# cd meta-rba5d2x/

STEP 5: Go to the created recipe directory and create sub directory ‘hello’. Go to the hello directory and create a ‘file’ directory go to the file directory and create a C file‘hello.c’ and write into the C file simple ‘hello world’ program.

root@13f28da9360f:/home/yocto/sources/meta-rba5d2x# mkdir recipes-sample/

root@13f28da9360f:/home/yocto/sources/meta-rba5d2x/recipes-sample# mkdir hello

root@13f28da9360f:/home/yocto/sources/meta-rba5d2x/recipes-sample# vim hello_0.1.bb

STEP 6: Create bb file in ‘hello’ direcory(ex:hello_0.1.bb) and write into the code hello_0.1.bb

root@13f28da9360f:/home/yocto/sources/meta-rba5d2x/recipes-sample# mkdir files

root@13f28da9360f:/home/yocto/sources/meta-rba5d2x/recipes-sample# vim hello.c

STEP 7: Change the directory to conf and modify the local.conf.

root@584a332c0218:/home/yocto/sources# cd poky

root@584a332c0218:/home/yocto/sources/poky# source oe-init-build-env

root@584a332c0218:/home/yocto/build# cd conf

root@584a332c0218:/home/yocto/build/conf# vim local.conf

STEP 8: Compile the project.

STEP 9: Stop the process.

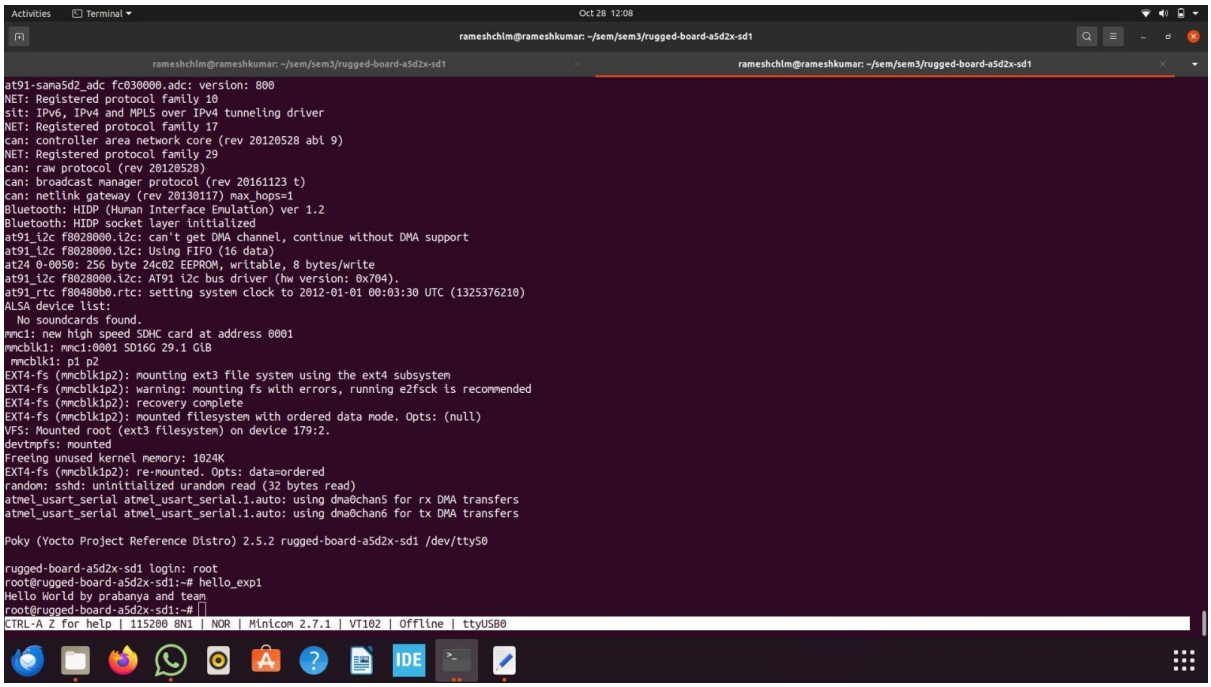
PROGRAM

local.conf:

```
# This sets the default machine to be rugged-board-a5d2x(NOR Flash) if no other machine is
selected:
MACHINE ?= "rugged-board-a5d2x-sd1"
# Default policy config
DISTRO ?= "poky-tiny"
# Package Management configuration
PACKAGE_CLASSES ?= "package_rpm"
# Extra image configuration defaults
EXTRA_IMAGE_FEATURES ?= "debug-tweaks"
# Interactive shell configuration
PATCHRESOLVE = "noop"
# Disk Space Monitoring during the build
BB_DISKMON_DIRS ??= "\
   STOPTASKS,${TMPDIR},1G,100K \
   STOPTASKS,${DL_DIR},1G,100K \
   STOPTASKS,${SSTATE_DIR},1G,100K \
   STOPTASKS,/tmp,100M,100K \
   ABORT,${TMPDIR},100M,1K \
   ABORT,${DL_DIR},100M,1K \
   ABORT,${SSTATE_DIR},100M,1K \
   ABORT,/tmp,10M,1K"
# Qemu configuration
PACKAGECONFIG_append_pn-qemu-native = " sdl"
PACKAGECONFIG_append_pn-nativesdk-qemu = " sdl"
#ASSUME_PROVIDED += "libsdl-native"

export PYTHONDONTWRITEBYTECODE="0"
```

INCLUDE_PYCS=""
# CONF_VERSION is increased each time build/conf/ changes incompatibly and is used to
# track the version of this file when it was generated. This can safely be ignored if
# this doesn't mean anything to you.
CONF_VERSION = "1"
IMAGE_INSTALL_append = " hello"

OUTPUT:



RESULT:

EX NO: 02 DATE:	**Explore and modify local, machine, and distro configuration files.**

AIM:

To create a simple Yocto project with basic configuration. Explore and modify local, machine, and distro configuration files.

ALGORITHM:

STEP 1: Start the process.

STEP 2: Pull and run an Ubuntu container.

STEP 3: Install the packages needed for yocto.

STEP 4: Create a directory ‘yocto-a5d2x’ in home directory, create a new directory ‘source’ and clone a git repositories,

git clone https://github.com/rugged-board/meta-rba5d2x.git -b sumo-rba5d2x

git clone https://github.com/rugged-board/poky.git -b sumo-rba5d2x

git clone git://git.openembedded.org/meta-openembedded -b sumo

git clone https://github.com/intel-iot-devkit/meta-iot-cloud.git -b sumo

STEP 5: Change the directory to poky and perform the command,

source oe-init-build-env

STEP 6: SD Card Flash Images:

For rugged board a5d2x(SDCARD)

i) Change the machine name to "rugged-board-a5d2x-sd1" in "conf/local.conf" as below.

$ vi conf/local.conf

ii) Set the machine as below and save the file.

MACHINE ?= "rugged-board-a5d2x-sd1"

iii) Compile the images for **SDCARD Flash** using below command.

$ bitbake rb-sd-core-image-minimal

iv) After completion of this compiling please go to below path to get the **SDCARD Flash** images.

$ cd tmp/deploy/images/rugged-board-a5d2x-sd1/

STEP 7: NOR Flash Images:

For rugged board a5d2x(NOR)
i) Change machine name to "rugged-board-a5d2x" in conf/local.conf as below.

$ vi conf/local.conf

ii) Set the machine as below and save the file.

MACHINE ?= "rugged-board-a5d2x"

iii) Compile the images for **NOR Flash** using below command.

$ bitbake rb-nor-core-image-minimal

iv) After completion of this compiling, please go to below path to get the **NOR Flash** images.

$ cd tmp/deploy/images/rugged-board-a5d2x/

STEP 8: Change the Distro on local.conf,

DISTRO ?= "poky-tiny"

STEP 8: And finally build your image and flash the Rugged Board.

STEP 10: Stop the Process.

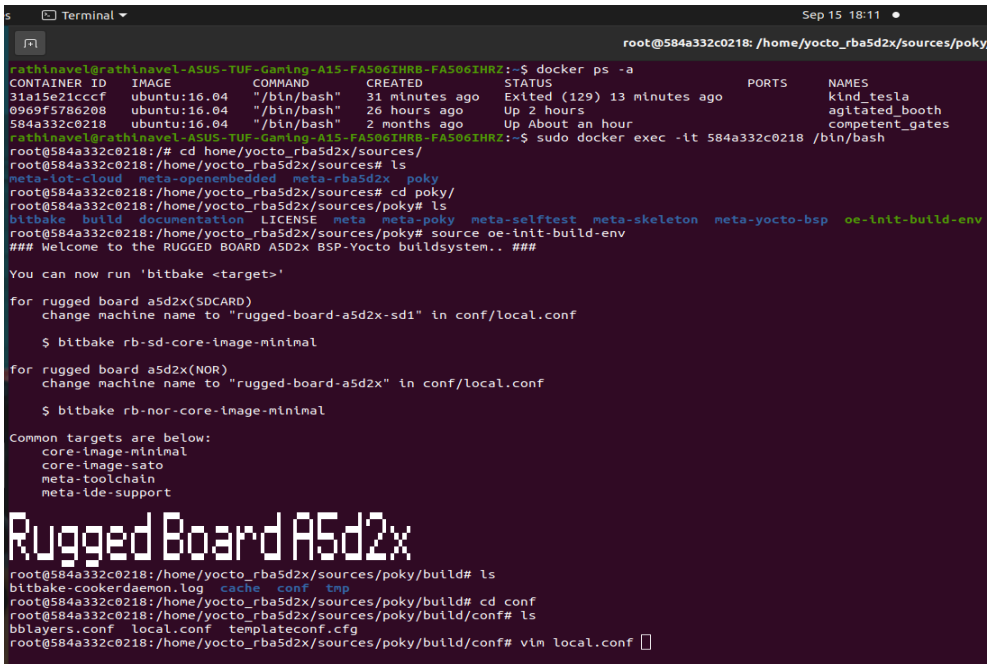
PROGRAM:

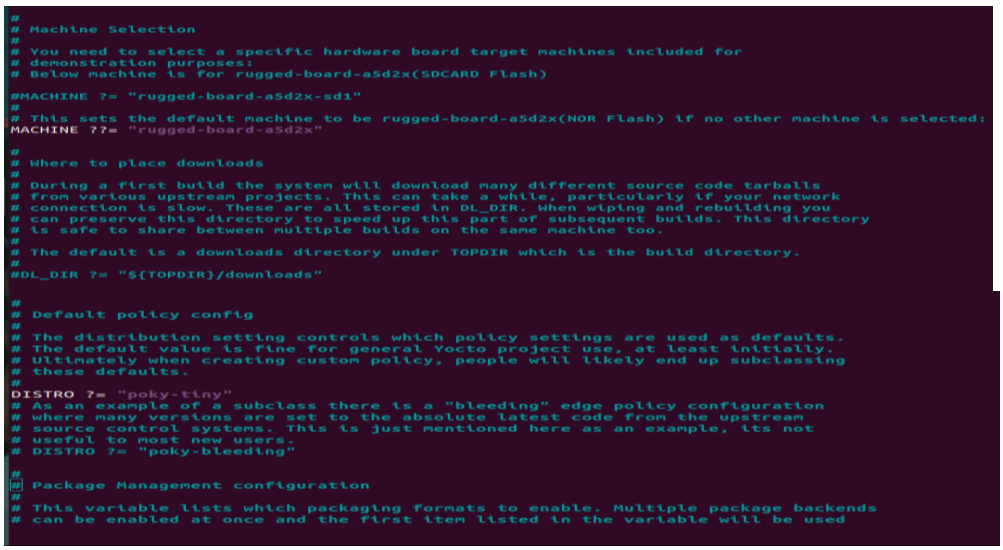
local.conf:

```
# demonstration purposes:
# Below machine is for rugged-board-a5d2x(SDCARD Flash)

MACHINE ?= "rugged-board-a5d2x-sd1"
#
# This sets the default machine to be rugged-board-a5d2x(NOR Flash) if no other machine is selected:
#MACHINE ??= "rugged-board-a5d2x"

# The distribution setting controls which policy settings are used as defaults.
# The default value is fine for general Yocto project use, at least initially.
# Ultimately when creating custom policy, people will likely end up subclassing
# these defaults.
```

#
DISTRO ?= "poky-tiny"
As an example of a subclass there is a "bleeding" edge policy configuration
where many versions are set to the absolute latest code from the upstream
source control systems. This is just mentioned here as an example, its not
useful to most new users.
DISTRO ?= "poky-bleeding"

OUTPUT:





RESULT:

EX NO: 03 **DATE:**	**Create mycalci recipe in meta-rb layer having source files app.c, add.c, mul.c, div.c, sub.c and myheader.h (take 3 command line arguments <num1> <operator> <num2>) fetch these from local source and then add recipe as a package in phy-image after that build and test this package.**

AIM:

To create mycalci recipe in meta-rb layer having source files app.c, add.c, mul.c, div.c, sub.c and myheader.h fetch these from local source and then add recipe as a package in phy-image after that build and test this package.

ALGORITHM:

STEP 1: First we create the Recipe for your project.

STEP 2: There are some basic commands are used for create recipe,

STEP 3: Create the Recipe Directory:
mkdir -p meta-custom/recipes-example/mycalci

STEP 4: Next, we write the new Recipe File.
Ex: mycalci_1.bb
“app.c, add.c, sub.c, mul.c, div.c, myheader.h "

STEP 5: After write the recipe file, add the License File: LICENSE = "MIT”.

STEP 6: Next, we Add the Recipe to Your Image.

STEP 7: A fter finish the all above process we should Build the Image by using the “bitbake core-image-minimal” command.

STEP 8: Once the build is complete, deploy your image to your target device or emulator.

STEP 9: After deploying the image, SSH into your target device or access the terminal of your emulator.

STEP 10: finally run the application.

STEP 11: Run the mycalci application to test it.

PROGRAM:

app.c

```
#include<stdio.h>
#include"myheader.h"
```

```
int main(int argc,char *argv[]){

        if(argc !=4){
                printf("Usage: %s <num1> <operator> <num2>\n",argv[0]);
                return 1;
        }

        double num1 = atof(argv[1]);
        char operator = argv[2][0];
        double num2 = atof(argv[3]);
        printf("A = %.2lf\n",num1);
        printf("B = %.2lf\n",num2);
        double result;

        switch(operator){
                case '+':
                        result = add(num1, num2);
                        break;
                case '-':
                        result = sub(num1, num2);
                        break;
                case '*':
                        result = mul(num1, num2);
                        break;
                case '/':
                        result = divsion(num1, num2);
                        break;
                default:
                        printf("Invalid Operator");
                        return 1;
        }

        printf("Result is '%c' operator :%.2lf\n",operator,result);
        return 0;
}
```

add.c

```
double add(double a,double b){
        return a+b;
}
```

sub.c

```
double sub(double a,double b){
        return a-b;
}
```

mul.c

```
double mul(double a,double b){
        return a*b;
}
```

div.c

```
#include<stdio.h>

double divsion(double a,double b){

        if(b !=0){
                 return a/b;
        }
        else{
                printf("Can not Divisible by zero \n");
                return 0;
        }
}
```

myheader.h

```
double add(double a,double b);
double sub(double a,double b);
double mul(double a,double b);
double divsion(double a,double b);
```

OUTPUT:

```
rugged-board-a5d2x-sd1 login: root
root@rugged-board-a5d2x-sd1:~# mycalci 20+30
Usage: mycalci <num1> <operator> <num2>
root@rugged-board-a5d2x-sd1:~# mycalci 20 + 30
Result: 50.000000
root@rugged-board-a5d2x-sd1:~# mycalci 20 - 30
Result: -10.000000
root@rugged-board-a5d2x-sd1:~# mycalci 20 "*" 30
Result: 600.000000
root@rugged-board-a5d2x-sd1:~# mycalci 20 / 30
Result: 0.666667
root@rugged-board-a5d2x-sd1:~#
```

RESULT:

EX NO: 04 DATE:	**Push your mycalci source to your github account then write the recipe mygit for fetching the source from git and then compile and install and generte a package and this package in phy-image and then build and test**.

AIM:

To create recipes in yocto and push the github account and compile the receipes.

ALGORITHM:

STEP 1: Create a C Code & Make file.

STEP 2: Run The Code.

STEP 3: Create a New Repository in Github Account.

STEP 4: Push the Recipe in Github Repository.

STEP 5: Set Up Yocto Environment.

STEP 6: Create a layer name meta-git by using command below.

Command 1.] bitbake-layers create-layer ../sources/meta-git

2.] bitbake-layers add-layer ../sources/meta-git

STEP 7: After create layer navigate to meta-git dir -> recipes-example ->create git directory

STEP 8: inside the git directory write the recipes with extension ".bb" inside the bb file write the code lines to process the c files inside the git repository.

STEP 9: Then compile the .bb file by using command "bitbake git".

PROGRAM:

```
#include <stdio.h>
void add() {
   float a, b;
   printf("Enter two numbers: ");
   scanf("%f %f", &a, &b);
   printf("Result: %.2f\n", a + b);
}
void subtract() {
```

```
    float a, b;
    printf("Enter two numbers: ");
    scanf("%f %f", &a, &b);
    printf("Result: %.2f\n", a - b);
}
void multiply() {
    float a, b;
    printf("Enter two numbers: ");
    scanf("%f %f", &a, &b);
    printf("Result: %.2f\n", a * b);
}
void divide() {
    float a, b;
    printf("Enter two numbers: ");
    scanf("%f %f", &a, &b);
    if (b != 0) {
        printf("Result: %.2f\n", a / b);
    } else {
        printf("Error: Division by zero is not allowed.\n");
    }
}
int main() {
    int choice;
    do {
        printf("\nSimple Calculator\n");
        printf("1. Add\n");
        printf("2. Subtract\n");
        printf("3. Multiply\n");
        printf("4. Divide\n");
        printf("5. Exit\n");
        printf("Choose an option: ");
```

```
        scanf("%d", &choice);
        switch (choice) {
            case 1: add(); break;
            case 2: subtract(); break;
            case 3: multiply(); break;
            case 4: divide(); break;
            case 5: printf("Exiting...\n"); break;
            default: printf("Invalid choice. Please try again.\n");
        }
    } while (choice != 5);
    return 0;
}
```

Make file:

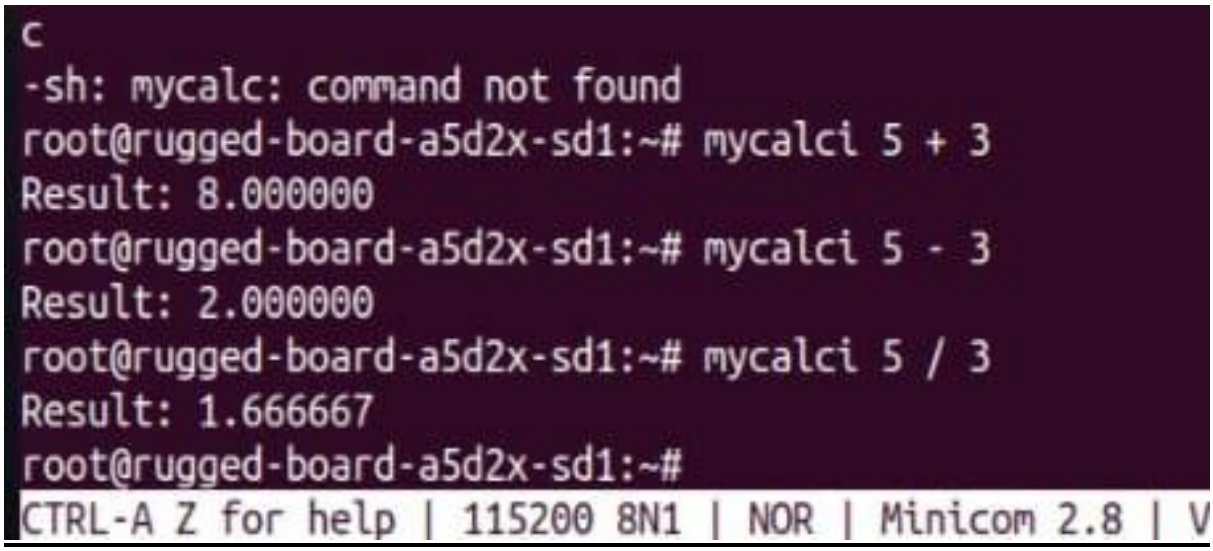
```
CC = gcc
CFLAGS = -Wall -Werror
SRC = calculator.c
UT = calculator
all: $(OUT)
$(OUT): $(SRC)
        $(CC) $(CFLAGS) -o $(OUT) $(SRC)
clean:
        rm -f $(OUT)
.PHONY: all clean
```

.bb file:

```
DESCRIPTION = "Simple calculator application"
LICENSE = "MIT"
LIC_FILES_CHKSUM =
"file://${COMMON_LICENSE_DIR}/MIT;md5=0835ade698e0bcf8506ecda2f7b4f302"
# Use SRC_URI for fetching the source
SRC_URI = "git://github.com/Surendar7550/mycalci.git;protocol=https;branch=main"
```

```
SRCREV = "e3e7af6c3974521864dfebe5d4e9b0d125024fc2"
S = "${WORKDIR}/git"
do_compile() {
    cd ${S}
    ${CC} ${CFLAGS} -Wl,--hash-style=gnu -o calculator calculator.c
}
do_install() {
    install -d ${D}${bindir}
    install -m 0755 ${S}/calculator ${D}${bindir}/
}
FILES_${PN} = "${bindir}/calculator"
```

OUTPUT:



RESULT:

EX NO: 05 DATE:	**Create a Static Library recipe mystatic having a source and header files for basic calculator application. In do_install( ) static lib (.a) add in {libdir} and header file add in {includedir} after that add package in phy-image and then build & test.**

AIM:

To create a static library named mystatic containing source and header files for a basic calculator application. This library will be installed in the appropriate directories ({libdir} for the .a file and {includedir} for the header file), added to the target image (phy-image), and then built and tested.

ALGORITHM:

STEP 1: Create Source Files**:**

- Create the source file calculator.c for the basic calculator functions (e.g., add, subtract, multiply, divide).
- Create the header file calculator.h for function declarations and constants.

STEP 2: Create Recipe Directory:

- Create a new directory for the mystatic recipe (e.g., recipes-mystatic).

STEP 3: Create mystatic.bb File:

- Define the static library recipe (mystatic.bb), specifying the source files and build instructions.

STEP 4: Define do_compile():

- Use the appropriate compilation commands to build the static library (calculator.a).

STEP 5: Define do_install():

- Install the static library (calculator.a) to {libdir}.
- Install the header file (calculator.h) to {includedir}.

STEP 6: Add to phy-image:

- Add mystatic to the IMAGE_INSTALL in the target image recipe (phy-image).

STEP 7: Build the Image:

- Run bitbake phy-image to build the image with the static library.

STEP 8: Test the Library**:**

- Create a simple test application to link against the calculator.a static library and ensure it works.

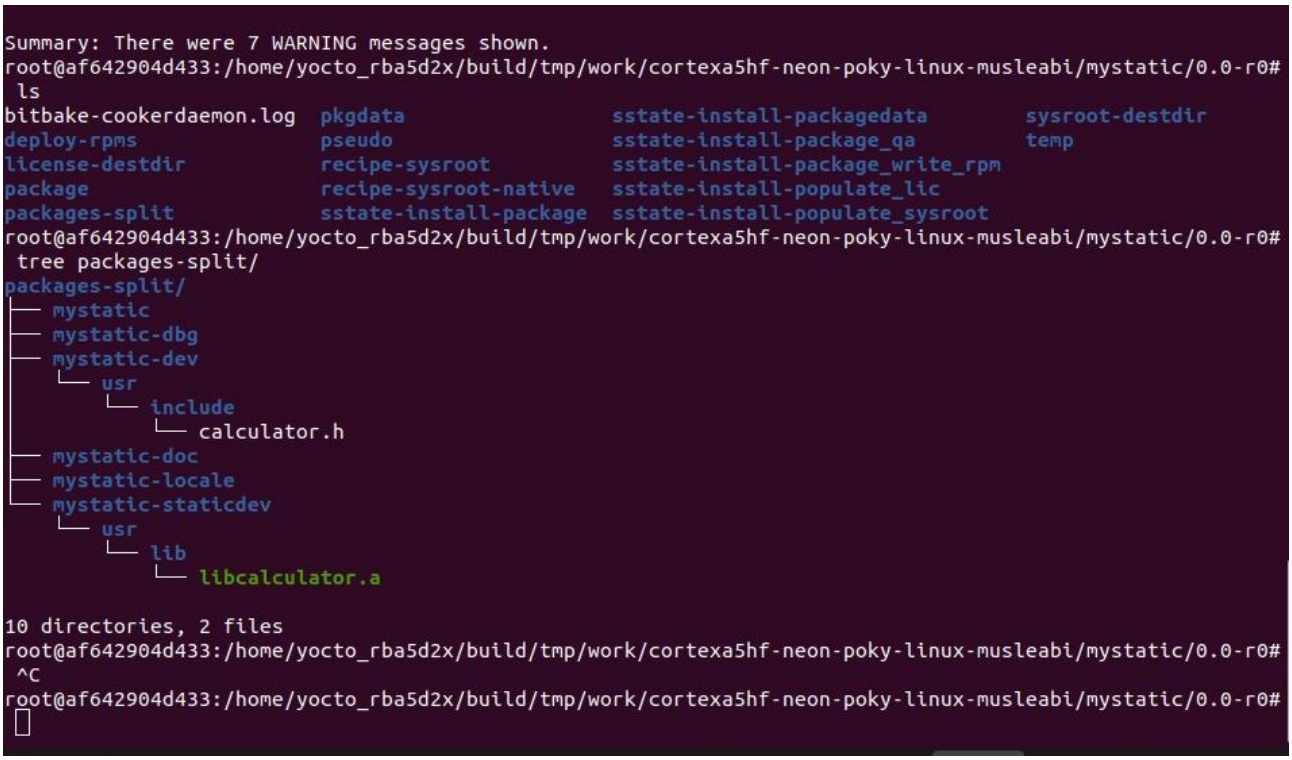
STEP 9: Verify Installation:

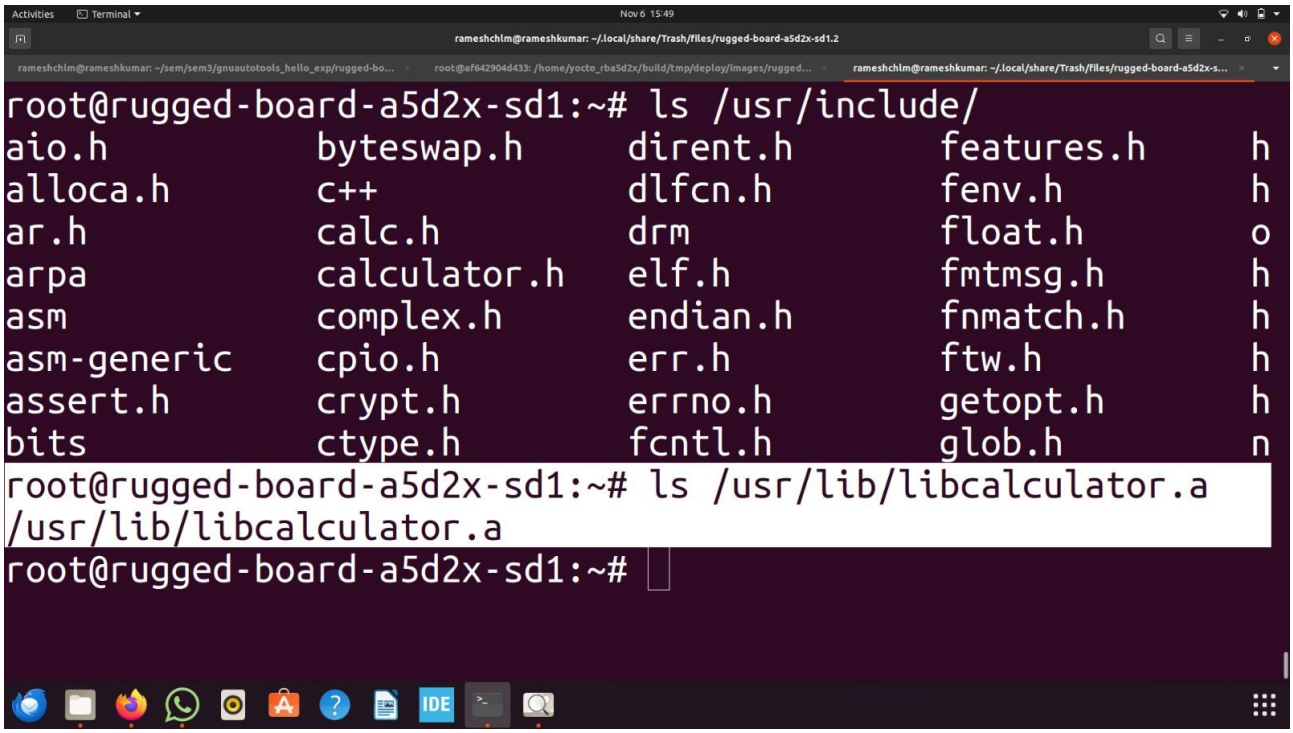
- Ensure the static library and header file are correctly installed in {libdir} and {includedir} in the target image.

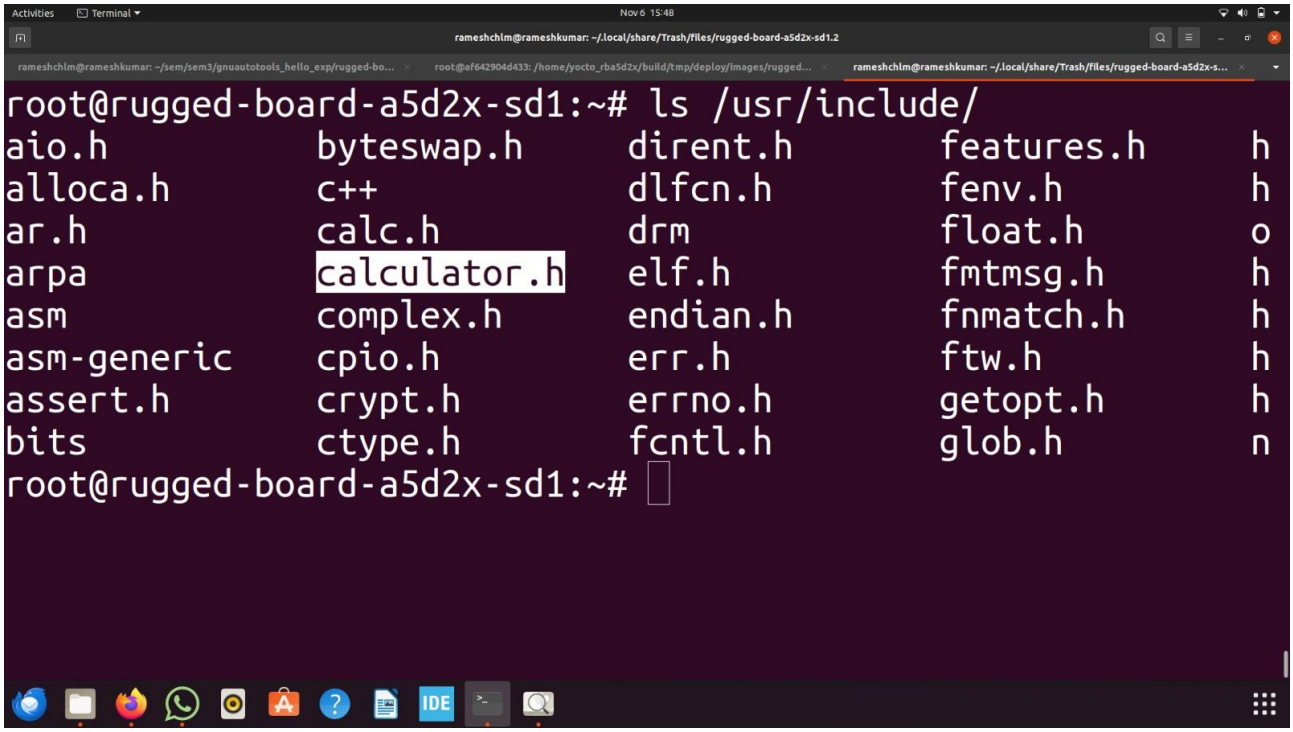
STEP 10: Run the Test:

- Test the target image to verify the calculator library functions are correctly integrated and working.

OUTPUT:




Activities
Terminal
Nov 6 15:49
rameshchlm@rameshkumar: ~/.local/share/Trash/files/rugged-board-a5d2x-sd1.2
root@rugged-board-a5d2x-sd1:~# ls /usr/include/
aio.h byteswap.h dirent.h features.h h
alloca.h c++ dlfcn.h fenv.h h
ar.h calc.h drm float.h o
arpa calculator.h elf.h fmtmsg.h h
asm complex.h endian.h fnmatch.h h
asm-generic cpio.h err.h ftw.h h
assert.h crypt.h errno.h getopt.h h
bits ctype.h fcntl.h glob.h n
root@rugged-board-a5d2x-sd1:~# ls /usr/lib/libcalculator.a
/usr/lib/libcalculator.a
root@rugged-board-a5d2x-sd1:~#


Activities
Terminal
Nov 6 15:48
rameshchlm@rameshkumar: ~/.local/share/Trash/files/rugged-board-a5d2x-sd1.2
root@rugged-board-a5d2x-sd1:~# ls /usr/include/
aio.h byteswap.h dirent.h features.h h
alloca.h c++ dlfcn.h fenv.h h
ar.h calc.h drm float.h o
arpa calculator.h elf.h fmtmsg.h h
asm complex.h endian.h fnmatch.h h
asm-generic cpio.h err.h ftw.h h
assert.h crypt.h errno.h getopt.h h
bits ctype.h fcntl.h glob.h n
root@rugged-board-a5d2x-sd1:~#

RESULT:

EX NO: 06 **DATE:**	**Create a Dynamic Library recipe mydynamic having a source and header files for basic calculator application. In do_install( ) dynamic lib (.so) add in {libdir} and header file add in {includedir} after that add package in phy-image and then build & test**

AIM:

To creating a dynamic library (mydynamic) that implements basic calculator functionality and packaging it within a Yocto image (phy-image), ensuring that the dynamic library and its header file are properly installed into their respective directories.

ALGORITHM:

STEP 1: Open the docker and move to home->yocto,then give the build command it is move move to

to home->yocto->build.

STEP 2: Then creating layer using this command

bitbake-layers create-layer ../sources/meta-mydynamic

then add the layer ,add layer command show an under the layer creation

STEP 3: Then move to home->yocto->sources->meta-layer->recipe-example

create inside two folder

mkdir mydynamic

mkdir phy-image

STEP 4: Go to home->yocto->sources->meta-layer->recipe-example->mydynamic

create a folder

mkdir files

STEP 5: Go to home->yocto->sources->meta-layer->recipe-example->mydynamic->files , create the two files calculator.c and calculator.h

STEP 6: Writing the code using vim editer ,Then save the files and quit

STEP 7: Come out from the files

cd ..

home->yocto->sources->meta-layer->recipe-example->mydynamic

create a recipe file mydynamic_0.1.bb

STEP 8: Write the code inside mydynamic_0.1.bb ,Then save and quit. This file compile and generate library file into usr/lib and header file into usr/include

STEP 9: Come out from the mydynamic and go inside the phy-image folder s

home->yocto->sources->meta-layer->recipe-example->phy-image

create the inside phy-image.bb file

STEP 10: Then start build process

home->yocto->build

give the commands:

bitbake phy-image

bitbake mydynamic(optional)

STEP 11: home->yocto->build->conf

local.conf

then include the mydynamic package into local.conf and packagegroup-core-buildessential this package used to gcc command working on rugged board

IMAGE_INSTALL_append = " mydynamic mydynamic-dev"

IMAGE_INSTALL_append = " packagegroup-core-buildessential"

STEP 12: Then give the bitbake command

STEP 13: home->yocto->build->tmp-deploy->image>rugged-board

copy the rugged board folder from the docker

docker cp <container_id_or_name>:<path_in_container> <path_on_host>

example:

docker cp abc123:/usr/src/app/file.txt ~/home/user/

that file are contain boot files and rootfs.

STEP 14: change the file names into the rugged board folder for boot files

then boot the sd card using this boot files and rootfs

then insert the sd card into rugged board start the boot process

STEP 15: after booting process create a c file

vi test.c

STEP 16: - gcc test.c -o test -I/usr/include -L/usr/lib -lcalculator

./test

-I refer the header file path –L refer the library path

STEP 17: Stop the program and finished.

PROGRAM:

calculator.h:

```
#ifndef MYCALCULATOR_H
#define MYCALCULATOR_H
int add(int a, int b);
int subtract(int a, int b);
int multiply(int a, int b);
int divide(int a, int b);
#endif
```

calculator.c:

```
#include "mycalculator.h"
int add(int a, int b) {
   return a + b;
}
int subtract(int a, int b) {
   return a - b;
}
int multiply(int a, int b) {
   return a * b;
}
int divide(int a, int b) {
   if (b == 0) return 0;  // Simple error handling for division by zero
   return a / b;
}
```

mydynamic_0.1.bb:

```
DESCRIPTION = "A dynamic library for basic calculator functions"
LICENSE = "MIT"
LIC_FILES_CHKSUM =
"file://${COMMON_LICENSE_DIR}/MIT;md5=0835ade698e0bcf8506ecda2
f7b4f302"
SRC_URI = "file://calculator.c \
        file://calculator.h"
```

```
S = "${WORKDIR}"

do_compile() {
    # Compile the source into a shared library
    ${CC} ${CFLAGS} ${LDFLAGS} -shared -fPIC -o libcalculator.so calculator.c
}

do_install() {
    # Install the dynamic library (.so) into the libdir
    install -d ${D}${libdir}
    install -m 0755 libcalculator.so ${D}${libdir}/libcalculator.so

    # Install the header file into the includedir
    install -d ${D}${includedir}
    install -m 0644 calculator.h ${D}${includedir}/calculator.h
}

FILES_${PN} = "${libdir}/libcalculator.so"
FILES_${PN}-dev = "${includedir}/calculator.h"
```

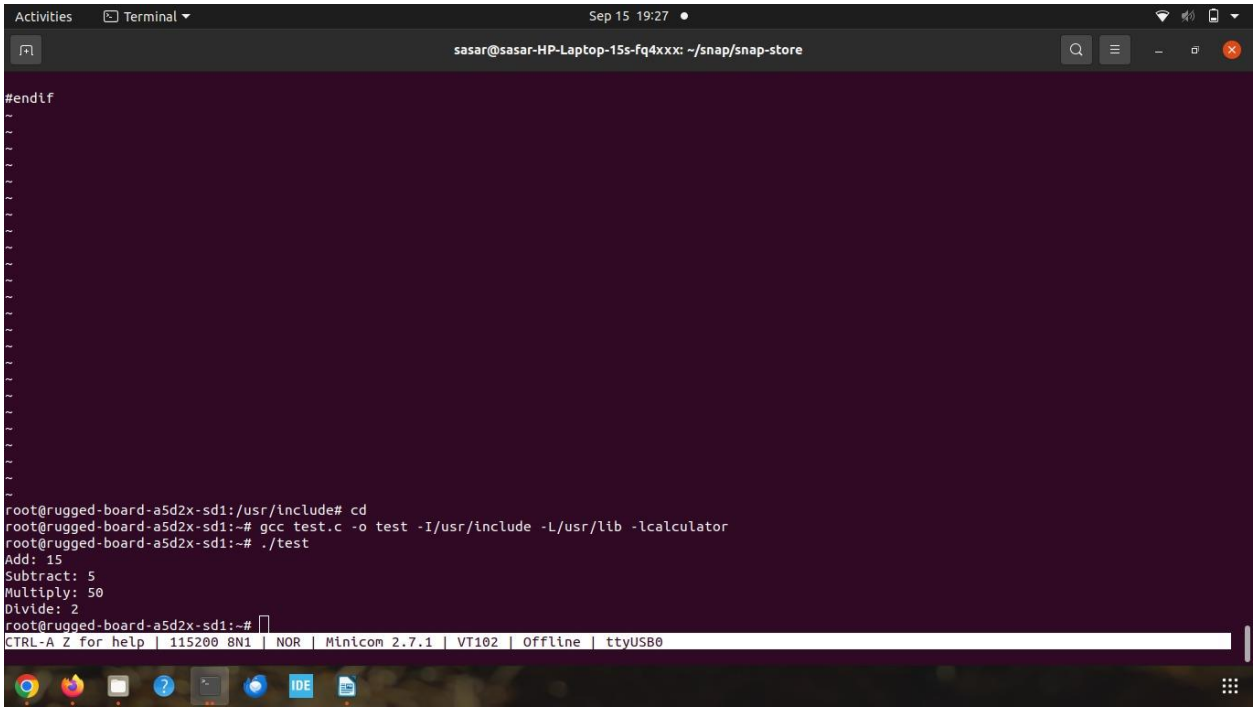
phy-image.bb:

```
DESCRIPTION = "Custom image including mydynamic"

LICENSE = "MIT"

IMAGE_INSTALL += "mydynamic"

IMAGE_INSTALL += "mydynamic mydynamic-dev"
```

test.c

```
#include <stdio.h>
#include "calculator.h"

int main() {
    int a = 10, b = 5;
    printf("Add: %d\n", add(a, b));
    printf("Subtract: %d\n", subtract(a, b));
    printf("Multiply: %d\n", multiply(a, b));
    printf("Divide: %d\n", divide(a, b));
    return 0;
}
```

OUTPUT:



RESULT:

EX NO: 07 DATE:	**Write a GNU helloworld autotool recipe to add GNU helloword package in phy-image and then build & test.**

AIM:

To write a GNU helloworld autotool recipe to add GNU helloword package in phy-image and then build & test.

ALGORITHM:

STEP 1: Start the process.

STEP 2: Pull and run an Ubuntu container.

STEP 3: Install the packages needed for yocto.

STEP 4: Create a directory(meta-example) which will house your BSP development.

STEP 5: Download and install GNU auto-tools config and intergrate to the layer

STEP 6: Create a recipe for the project

STEP 7: Change the directory to poky and Set up the build environment by sourcing the " oe-init-build-env " script.

STEP 8: Run bitbake phy-image in build

STEP 9: Stop the process.

PROGRAM:

RECIPIE FILE

auto_hello.bb:

```
DESCRIPTION = "Simple helloworld application"
LICENSE = "MIT"
LIC_FILES_CHKSUM =
"file://${COMMON_LICENSE_DIR}/MIT;md5=0835ade698e0bcf8506ecda2f7b4f302"
SRC_URI = "file://auto-hello-1.0.tar.gz"
#S = "${WORKDIR}/auto-hello-1.0"
#PROVIDES += "myphy"
inherit autotools
```

The Major files inside auto hello files tar.gz

userprog.c

```
#include<stdio.h>
int main()
{
        printf("Hello world\n");
        return 0;
}
```

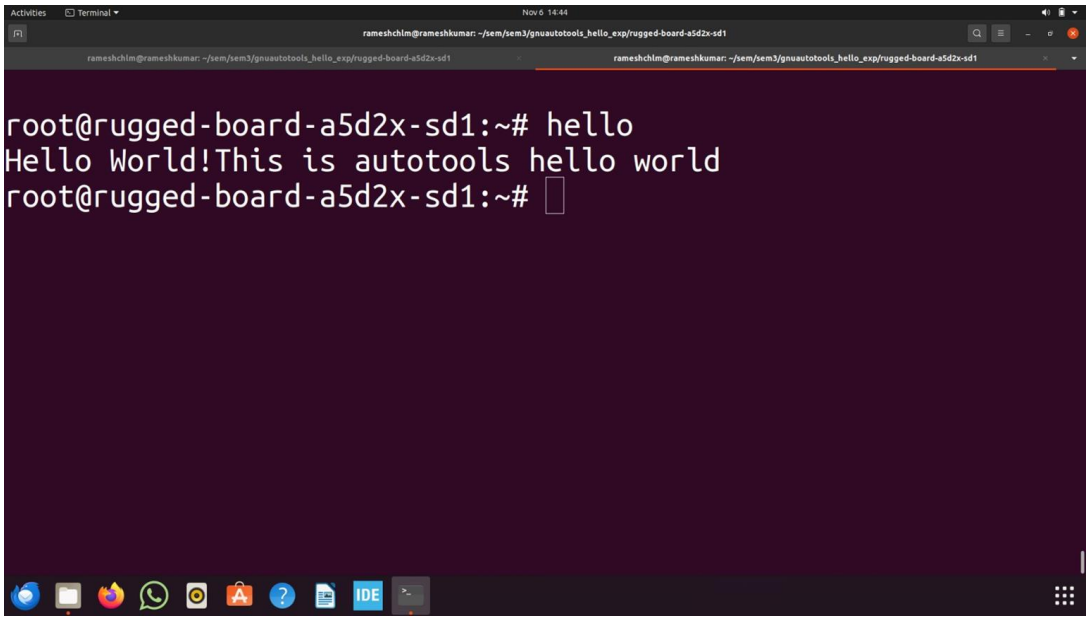
configure.ac:

```
 AC_INIT([auto-hello], [1.0], [panidharece2023@gmail.com])
AM_INIT_AUTOMAKE([-Wall -Werror foreign])
AC_PROG_CC
AC_CONFIG_FILES([Makefile])
AC_OUTPUT
```

Makefile.am:

```
bin_PROGRAMS = myhello

myhello_SOURCES = userprog.c
```

OUTPUT:



RESULT:

EX NO: 08 DATE:	Experiment with character device driver in YOCTO

AIM:

Experiment with character device driver in YOCTO.

ALGORITHM:

STEP 1: Start the process.

STEP 2: path for kernel source in yocto to write a device driver code is is
root@af642904d433:/home/yocto_rba5d2x/build/tmp/work/rugged_board_a5d2x_sd1-poky-linux-musleabi/linux-rba5d2x/4.9-r0/git/drivers/char/mydriver/#

STEP 3: Create C file 'mychardriver.c' and write the code

'vim mychardriver.c'.

STEP 4: @Makefile -> add this

obj-$(@Kconfig -> add the content

menuconfig MYCHARDRIVER

tristate "My Character Device Driver"

default n

help

Enable support for My Character Device Driver.

if MYCHARDRIVER

config MYCHARDRIVER_ENABLE

tristate "Enable My Character Device Driver"

default m

help

This enables the mychardriver character device driver.

endif

root@af642904d433:/home/yocto_rba5d2x/build/tmp/work/rugged_board_a5d2x_sd1-poky-linux-musleabi/linux-rba5d2x/4.9-r0/git/drivers/char/

@Makefile

obj-$(CONFIG_MYCHARDRIVER) += mychardriver.o

@Kconfig

config MYCHARDRIVER

tristate "Enable My Character Device Driver"

depends on SOME_DEPENDENCY

default n

help

This option enables the My Character Device Driver.

The driver provides access to a simple character device.

Source additional configurations from another Kconfig filesource "drivers/char/mydriver/Kconfig"_MYCHARDRIVER_ENABLE) += my_char_device.o.

STEP 5: bitbake -c menuconfig virtual/kernel.

STEP 6: Stop the process.

PROGRAM:

mychardriver.c

```
#define MAX_DEV 2

#define BUFFER_SIZE 128

static int mychardev_open(struct inode *inode, struct file *file);

static int mychardev_release(struct inode *inode, struct file *file);

static long mychardev_ioctl(struct file *file, unsigned int cmd, unsigned long arg);

static ssize_t mychardev_read(struct file *file, char __user *buf, size_t count, loff_t *offset);

static ssize_t mychardev_write(struct file *file, const char __user *buf, size_t count, loff_t *offset);
```

```
static const struct file_operations mychardev_fops = {
    .owner          = THIS_MODULE,
    .open           = mychardev_open,
    .release        = mychardev_release,
    .unlocked_ioctl = mychardev_ioctl,
    .read           = mychardev_read,
    .write          = mychardev_write,
};
struct mychar_device_data {
    struct cdev cdev;
    char *buffer; // To hold user data
    struct mutex mutex; // For synchronization
};
static int dev_major = 0;
static struct class *mychardev_class = NULL;
static struct mychar_device_data mychardev_data[MAX_DEV];

static int mychardev_uevent(struct device *dev, struct kobj_uevent_env *env) {
    add_uevent_var(env, "DEVMODE=%#o", 0666);
    return 0;
}
static int __init mychardev_init(void) {
    int err, i;
    dev_t dev;

    err = alloc_chrdev_region(&dev, 0, MAX_DEV, "mychardev");
    if (err < 0) {
        printk(KERN_ERR "Failed to allocate char device region\n");
        return err;
    }
    dev_major = MAJOR(dev);
```

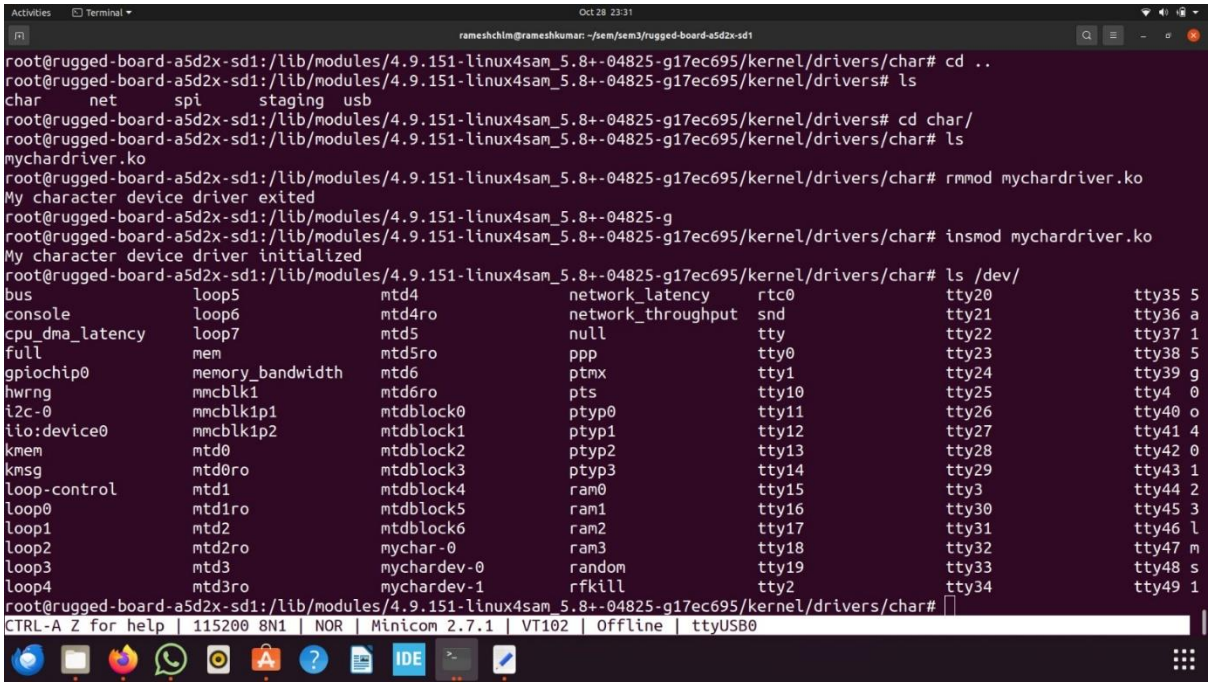
```
    mychardev_class = class_create(THIS_MODULE, "mychardev");
    if (IS_ERR(mychardev_class)) {
        unregister_chrdev_region(dev, MAX_DEV);
        return PTR_ERR(mychardev_class);
    }
    mychardev_class->dev_uevent = mychardev_uevent;
    for (i = 0; i < MAX_DEV; i++) {
        cdev_init(&mychardev_data[i].cdev, &mychardev_fops);
        mychardev_data[i].cdev.owner = THIS_MODULE;

        mychardev_data[i].buffer = kmalloc(BUFFER_SIZE, GFP_KERNEL);
        if (!mychardev_data[i].buffer) {
            printk(KERN_ERR "Failed to allocate memory for device %d\n", i);
            while (--i >= 0) {
                kfree(mychardev_data[i].buffer);
                cdev_del(&mychardev_data[i].cdev);
            }
            class_destroy(mychardev_class);
            unregister_chrdev_region(dev, MAX_DEV);
            return -ENOMEM;
        }
        mutex_init(&mychardev_data[i].mutex);
        cdev_add(&mychardev_data[i].cdev, MKDEV(dev_major, i), 1);
        device_create(mychardev_class, NULL, MKDEV(dev_major, i), NULL, "mychardev-
%d", i);
    }
    printk(KERN_INFO "My character device driver initialized\n");
    return 0;
}
static void __exit mychardev_exit(void) {
    int i;
```

```
    for (i = 0; i < MAX_DEV; i++) {
        device_destroy(mychardev_class, MKDEV(dev_major, i));
        kfree(mychardev_data[i].buffer);
        cdev_del(&mychardev_data[i].cdev);
    }
    class_unregister(mychardev_class);
    class_destroy(mychardev_class);
    unregister_chrdev_region(MKDEV(dev_major, 0), MAX_DEV);

    printk(KERN_INFO "My character device driver exited\n");
}
static int mychardev_open(struct inode *inode, struct file *file) {
    struct mychar_device_data *dev_data = container_of(inode->i_cdev, struct
mychar_device_data, cdev);
    file->private_data = dev_data;
    printk(KERN_INFO "MYCHARDEV: Device open\n");
    return 0;
}
static int mychardev_release(struct inode *inode, struct file *file) {
    printk(KERN_INFO "MYCHARDEV: Device close\n");
    return 0;
}
static long mychardev_ioctl(struct file *file, unsigned int cmd, unsigned long arg) {
    printk(KERN_INFO "MYCHARDEV: Device ioctl\n");
    return 0;
}
static ssize_t mychardev_read(struct file *file, char __user *buf, size_t count, loff_t *offset) {
    struct mychar_device_data *dev_data = file->private_data;
    size_t datalen = strlen(dev_data->buffer);

    if (*offset >= datalen) {
```

```
        return 0; // End of file
    }
    if (count > datalen - *offset) {
        count = datalen - *offset; // Adjust count to remaining data
    }
    if (copy_to_user(buf, dev_data->buffer + *offset, count)) {
        return -EFAULT;
    }
    *offset += count; // Update offset for the next read
    printk(KERN_INFO "MYCHARDEV: Read %zu bytes\n", count);
    return count;
}
static ssize_t mychardev_write(struct file *file, const char __user *buf, size_t count, loff_t
*offset) {
    struct mychar_device_data *dev_data = file->private_data;
    size_t maxdatalen = BUFFER_SIZE - 1; // Reserve space for null terminator
    if (count > maxdatalen) {
        count = maxdatalen; // Limit the number of bytes to write
    }
    mutex_lock(&dev_data->mutex); // Lock for synchronization

    // Clear the buffer before copying to prevent garbage values
    memset(dev_data->buffer, 0, BUFFER_SIZE);

    if (copy_from_user(dev_data->buffer, buf, count)) {
        mutex_unlock(&dev_data->mutex);
        return -EFAULT;
    }
    dev_data->buffer[count] = '\0'; // Null-terminate the string
    *offset += count; // Update offset
    printk(KERN_INFO "MYCHARDEV: Wrote %zu bytes: %s\n", count, dev_data->buffer);
```

```
    mutex_unlock(&dev_data->mutex); // Unlock after the operation
    return count;
}
MODULE_LICENSE("GPL");
MODULE_AUTHOR("Rameshkumar_Hari_BelthaArthi");
module_init(mychardev_init);
module_exit(mychardev_exit);
```

OUTPUT:



RESULT:

EX NO: 09 **DATE:**	**In meta-rb layer create image recipe phy-image by inherit core-image bbclass and then add ssh-server-dropbear, read-only-rootfs features in your Image after adding build the image.**

AIM:

To create meta-rb layer create image recipe phy-image by inherit core-image bbclass and then add ssh-server-dropbear, read-only-rootfs features in your Image after adding build the image.

ALGORITHM:

STEP 1: Start the process.

STEP 2: Set Up the Docker container

STEP 3: In the `meta-rb` layer, create a directory for your custom image

STEP 4: touch meta-rb/recipes-core/images/phy-image.bb

$ mkdir -p meta-rb/recipes-core/images

STEP 5: Create a new BitBake recipe file for `phy-image`

$ touch meta-rb/recipes-core/images/phy-image_0.1.bb

STEP 6: Open `phy-image.bb` in a text editor and define the image, inherit core-image and Add image features “ssh-server-dropbear read-only-rootfs”

STEP 7: Creates a new recipe file for your custom image named phy-image.bb.

STEP 8: Open your build configuration file, typically `conf/local.conf`, in your Yocto build directory and Add `phy-image` as your default image to be built by setting `IMAGE_INSTALL`

```
IMAGE_INSTALL += "phy-image"
```

STEP 9: Ensure that the `meta-rb` layer is included in your build configuration. If it’s not, add it to `bblayers.conf`

**/home/yocto_rba5d2x/sources/meta-rb **

STEP 10: Change the directory to poky and perform the command,

 # source oe-init-build-env

STEP 11: To build the custom image,

bitbake phy-image

STEP 12: Copy the images in the docker to host PC

docker cp 584a332c0218:/home/yocto_rba5d2x/build/tmp/deploy
/images/rugged-board-a5d2x-sd1 ~/phyimage

STEP 13: Copy that images to SD Card and flash the Rugged Board

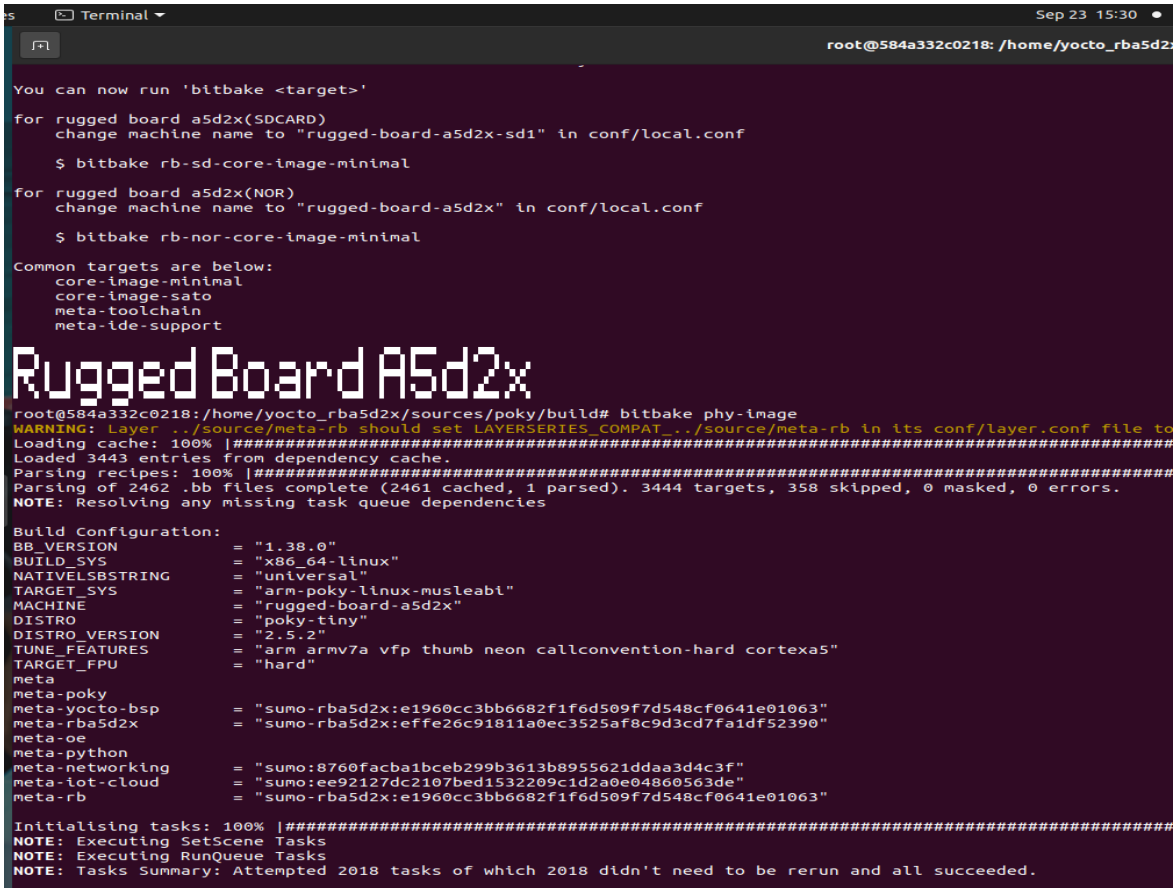
STEP 14: Stop the Process

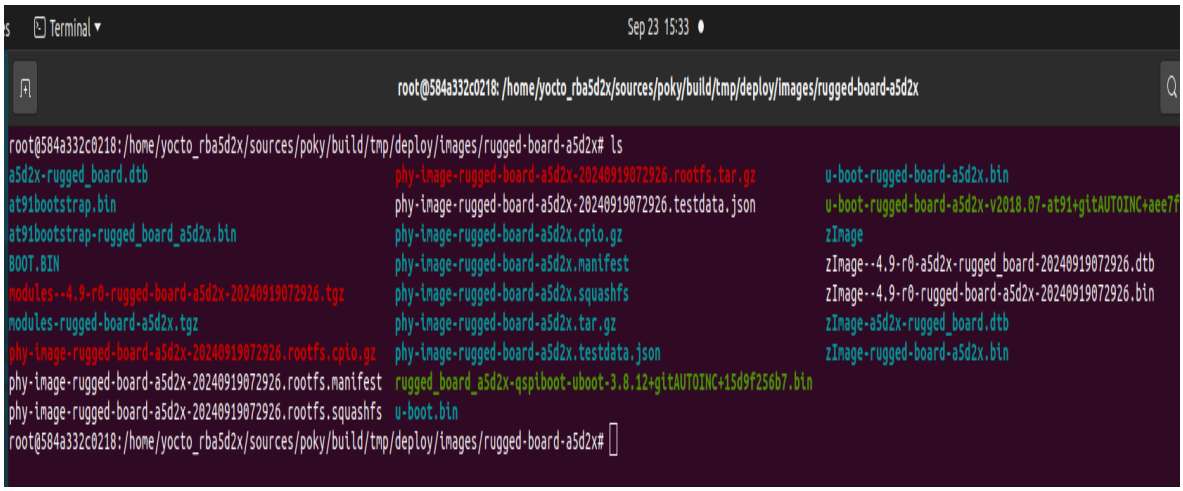
PROGRAM:

phy-image_0.1.bb

```
DESCRIPTION = "Custom image recipe for phy-image with SSH and read-only root
filesystem features"
LICENSE = "MIT"

# Inherit core-image to base the image on standard core image structure
inherit core-image

# Add the required packages and features
IMAGE_FEATURES += "ssh-server-dropbear read-only-rootfs"
```

OUTPUT:





RESULT:

EX NO: 10 DATE:	**Create the Recipe an helloworld and to Patch the file on Git using Yocto.**

AIM:

To Create the Recipe an helloworld and to Patch the file on Git using Yocto

ALGORITHM:

STEP 1: First we Create the Recipe for your project.

STEP 2: There are some basic commands are used for create recipe,

STEP 3: Create the Recipe Directory:

mkdir -p meta-custom/recipes-example/mycalci

STEP 4: clone your Github To use Remote Repositiory in Yocto Project

"git clone https://github.com//username.git"

STEP 5: Next, we write the new Recipe File.

Ex: mycalci_1.bb

"helloworld.c"

STEP 6: To create the .bb file then include "do_patch(),do_compaile(),do_install()" commands

STEP 7: After write the recipe file, add the License File: LICENSE = "MIT".

STEP 8: Next, we add the Recipe to Your Image.

STEP 9: After finish the all above process we should Build the Image by using the "bitbake core-image-minimal" command.

STEP 10: Once the build is complete, deploy your image to your target device or emulator.

STEP 11: After deploying the image, SSH into your target device or access the terminal of your emulator.

STEP 12: finally run the appilication.

STEP 13: Run the patch_hello application to test it.

PROGRAM:

helloworld.c

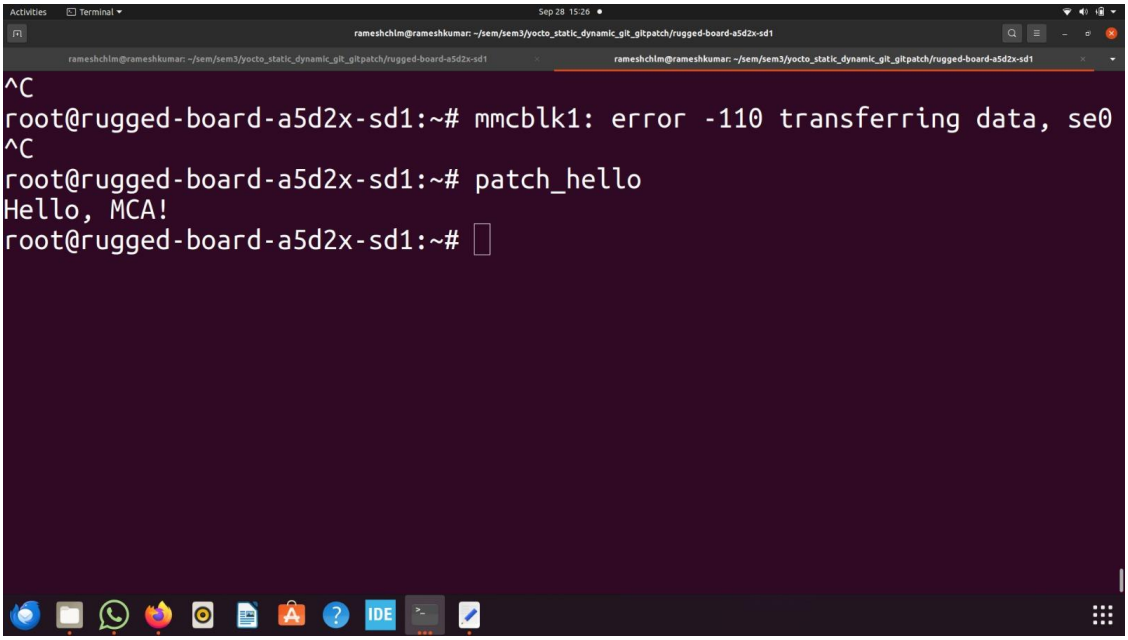
```
#include<stdio.h>
int main(){
        printf("Hello, World!\n");
```

```
        return 0;
    }
```

patch_hello.patch

```
    #include<stdio.h>
    int main(){
        printf("Hello, World!\n");
        return 0;
    }
```

OUTPUT:



RESULT: