A
Project Report
On
" Real time executable file generation of computer vision algorithm "

(CE346 – Summer Internship-1)

Prepared by

Mr Jayeshbhai Vejabhai Bhutiya (16CE010)

Under the Supervision of

Prof. Dippal Israni

Submitted to

Charotar University of Science & Technology (CHARUSAT)
for the Partial Fulfillment of the Requirements for the
Degree of Bachelor of Technology (B.Tech.)
in Computer Engineering (CE)
for 5th semester B.Tech

Submitted at

Accredited with Grade A by NAAC
Accredited with Grade A by KCG

U & P U. PATEL DEPARTMENT OF COMPUTER ENGINEERING
(NBA Accredited)
Chandubhai S. Patel Institute of Technology (CSPIT)
Faculty of Technology & Engineering (FTE), CHARUSAT
At: Changa, Dist: Anand, Pin: 388421.
June, 2018

DECLARATION BY THE CANDIDATE

I hereby declare that the project report entitled "Real time executable file generation of computer vision algorithm" submitted by me to Chandubhai S. Patel Institute of Technology, Changa in partial fulfilment of the requirement for the award of the degree of **B.Tech** in Computer Engineering, from U & P U. Patel Department of Computer Engineering, CSPIT/FTE, is a record of bonafide **CE346 Summer Intership-1** carried out by me under the guidance of **Prof. Dippal Israni**. I further declare that the work carried out and documented in this project report has not been submitted anywhere else either in part or in full and it is the original work, for the award of any other degree or diploma in this institute or any other institute or university.

Mr Jayeshbhai vejabhai Bhutiya(16CE010)

Prof. Dippal Israni
Assistant Professor
U.&P.U Patel Dept. of Computer Engg./CSRTC
C.S.P.I.T., CHARUSAT-Changa.

CHARUSAT
CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

Accredited with Grade A by NAAC
Accredited with Grade A by KCG

Charusat
Space
Research
Technology
Center

CERTIFICATE

This is to certify that Mr **Jayeshbhai Vejabhai Bhutiya** of B.TECH in Computer Engineering in Academic Year 2016-20 of Chandubhai S. Patel Institute of Technology, CHARUSAT has successfully completed his/her 5th semester Internship.

The project was undertaken by him in **Summer Intership-1 (CE346)** titled as **" Real time executable file generation of computer vision algorithm "**during academic period from **June 2018** to **July 2018**.

The Project Internship fulfills all the stated criteria and the students finding are his original work.

I hereby certify his work excellent to the best of my knowledge.

Prof. Dippal Israni
Assistant Professor
U.&P.U Patel Dept. of Computer Engg./CSRTC
C.S.P.I.T., CHARUSAT-Changa.

Dr. S.P.Kosta
Director, CSRTC,
CHARUSAT University-
Changa.

Charusat Space Research and Technology Center (CSRTC)

CHARUSAT, At: Changa, Dist: Anand, Pin: 388421.

April, 2017

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Accredited with Grade A by NAAC
Accredited with Grade A by KCG

CERTIFICATE

This is to certify that the report entitled “**Real time executable file generation of computer vision algorithm**” is a bonafied work carried out by **Mr Jayeshbhai Vejabhai Bhutiya(16CE010)** under the guidance and supervision of **Prof. Rajesh Patel & Prof. Dippal Israni** for the subject **Summer Intership-1 (CE346)** of 5th Semester of Bachelor of Technology in **Computer Engineering** at Chandubhai S. Patel Institute of Technology (CSPIT), Faculty of Technology & Engineering (FTE) – CHARUSAT, Gujarat.

To the best of my knowledge and belief, this work embodies the work of candidate himself, has duly been completed, and fulfills the requirement of the ordinance relating to the B.Tech. Degree of the University and is up to the standard in respect of content, presentation and language for being referred by the examiner(s).

Under the supervision of,

Prof. Dippal Israni
Assistant Professor
U.&P.U Patel Dept. of Computer Eng/CSRTC
C.S.P.I.T., CHARUSAT-Changa.

Dr. (Prof.) Amit Ganatra
Head - U & P U. Patel Department of Computer Engineering,
Dean - Faculty of Technology & Engineering (FTE),
CHARUSAT, Changa, Gujarat.

Chandubhai S. Patel Institute of Technology (CSPIT)

Faculty of Technology & Engineering (FTE), CHARUSAT

At: Changa, Ta. Petlad, Dist. Anand, Pin:388421. Gujarat.

ABSTRACT

My internship is on project named “Real time executable file generation of computer vision algorithm”. I done my internship at Charusat Space Research and Technology Center (CSRTC), charusat university, changa, Gujarat from June 2018 to July 2018 .We worked on the generation of executable file as I mention in my project title. For that we used matlab tool.

The Aim of project is to create a standalone application that can be deliverable. It provide the gui for user such that nontechnical person can evaluate it and technical person can view it.

ACKNOWLEGEMENT

With immense pleasure, I would like to present this Internship report on "Real time executable file generation of computer vision algorithm". It has been an enriching experience for me to undergo my summer training at Charusat Space Research and Technology Center (CSRTC), which would not have possible without the goodwill and support of the people around.

As a student of CHANDUBHAI S. PATEL INSTITUTE OF TECHNOLOGY, I am highly thankful to **Dr. Amit Ganatra** (Head of CE Department CSPIT, Charusat University, Changa.) who allowed me for this Internship at Charusat Space Research and Technology Center (CSRTC).

I would like to give my heartily thanks to **Mr.Dippal Israni** who guided me and support throughout the Internship. Without them I would not be able to complete this project successfully. I am very thankful to whole staff who helped me at every step whenever needed.

I sincerely thanks to my faculty guide **Mr. Rajesh Patel**,for providing understanding on the ways of preparing a project report and for the guidance and support for Summer Training.

TABLE OF CONTENTS

PART 1- ORGANISATIONAL PROFILE

1. INTRODUCTION

NAME OF THE COMPANY	**“Charusat Space Research and Technology Center(CSRTC)”**
ADDRESS	Charotar University of Science & Technology CHARUSAT Campus-Changa Off. Nadiad-Petlad Highway Gujarat (India) 388 421 INDIA
TELEPHONE	02697-265011/21
FAX NO.	02697-265007
E-MAIL	info@charusat.ac.in
LOCATION	In The Department Of Iiim (Indukaka Ipcowala Institute Of Management,Charusat,Changa,388 421)
NATURE OF THE COMPANY	Research And Development Center Associated With Space Defence And Naval Units
TYPE OF THE COMPANY	Research And Development Center Of Academic University
MAIN BUSINESS	Research And Development Center Associated With Space Defence And Naval Units
REASON FOR SELECTION LOCATION	• The Availability Of Technology Resources • Definition Is Strong

2. THE COMPANY/ ORGANISATION

2.1 EVOLUTION AND HISTORY

- **Charusat Space Research and Technology Center (CSRTC)** was set up on 15th June 2013. The purpose of establishing the department is to encourage the inspiration and expansion in the field of space technology. It has the following broad objectives to provide the best possible educational facilities for training students for the careers in Space Technology, to provide a healthy atmosphere for the students and the faculty for higher studies and research, to provide research and development consultancy, to establish bridge between university and industry to provide services to industries and to community.
- CHARUSAT Space Technology Center of CHARUSAT has a student Nano satellite Program to develop a Nano satellite called "SARASWATI" under the ISRO Student Satellite Program (Submitted to ISRO, Nov 2013) with the guidance and support of ISRO.
- In this concern two meetings were held at CHARUSAT campus on 17/08/2013 and 23/12/2013 and two at ISRO Ahmadabad on 12/09/2013 and 16/12/2013.
- **MOU between CHARUSAT and SAC, ISRO, Ahmedabad on 3rd February 2014.**

2.2 MISSION AND VISION

- **MISSION OF THE ORGANIZATION**

To contribute remarkable experience of designing and development of satellite and subsystems.

- **VISION OF THE ORGANIZATION**

To become an excellent ensemble in space technology field.

2.3 PRODUCTS

- Presently, the centre works on a student Nano Satellite Program to develop a Nano satellite called “SARASWATI” under the ISRO Student Satellite Program. Further, SAC, ISRO, Ahmedabad has approved five research proposals submitted by CHARUSAT. Currently, the center is working on these five projects and Student Nano Satellite Program. For the purpose, an MOU has also been signed between CHARUSAT and SAC, ISRO, Ahmedabad on 3rd February 2014.
- The Center Also Works On Microwave Processing, Remote Sensing, Computer Vision, Machine Learning, Image Processing And Vibration Handling,

2.4 GEOGRAPHICAL SPREAD OF FACILITIES

- CHARUSAT Space Technology Center of CHARUSAT has a student Nano satellite Program to develop a Nano satellite called “SARASWATI” under the ISRO Student Satellite Program (Submitted to ISRO, Nov 2013) with the guidance and support of ISRO.
- In this concern two meetings were held at CHARUSAT campus on 17/08/2013 and 23/12/2013 and two at ISRO Ahmadabad on 12/09/2013 and 16/12/2013.
- **MOU between CHARUSAT and SAC, ISRO, Ahmedabad on 3rd February 2014.**
- SAC, ISRO, Ahmedabad has approved five proposals. Currently center is working on these five projects and Student Nano satellite Program.
- CSRTC also has 5 research projects with IPR, 1 from IRDE (DRDO) and 1 from CRL-BEL

3.TASKS AND ACTIVITIES PERFORMED AT THE ORGANISATION

- Learn Basic Functionality Of **Matlab**(R2016A).
- Perform Tasks That Help METO Improve My Skill In **Matlab.**
- Sir Guided Me About The Features Of **Matlab** .
- Perform Some Basic Operation On Image(Image Processing).
- Learn The Workflow Of **Deploytool** (Toolbox Of **Matlab**).
- Install **Opencv**(Open Computer Vision) And Connect The **Opencv** With **Codeblocks.**
- Convert Matlab(.**M**) File To **Dll**(Dynamic Link Library).
- Learn The Basic Functionality Of Coder Toolbox Of **Matlab**.
- Convert The **.M** File To **C/C++** File By Using Coder Toolbox.
- At The End Create A Standalone Application(.Exe) .

4. LEARNING EXPERIENCE

- Learn new Things That I Haven’t Learn Yeat.
- For example Clear The Idea In The Field Of Image Processing
- Learn The New Functionality Of **Matlab** Tool Like Deploytool,Coder…
- Whenever There Is Confusion Or Any Doubt In My Mind, Sir Provide Me Proper Guidance To Solve My doubt.
- I Increased My Focus More On Work.
- Experience the Load Of Work.
- Learn the Value of Time.

PART II – PROJECT STUDY

5. OVERVIEW OF THE PROJECT

“Real time executable file generation of computer vision algorithm”

5.1 BACKGROUND OF THE STUDY

To full fill the requirement of our project the study of basic matlab is required. Study of the application deployment tool is required for our project because the generation of executable file is done by the Application Deployment tool.

Our deployment tools all focus on the same basic process: transforming a collection of functions written in MATLAB into an application or library that can be used outside of MATLAB.

The MATLAB Compiler and Builders allow you to deploy MATLAB applications as:

- Stand-alone executables
- C or C++ libraries
- Microsoft .NET or COM components (local or remote)
- Java classes
- Microsoft Excel add-ins

A deployed application consists of a collection of MATLAB-based functions and data packaged for a particular target environment. For example, the MATLAB Compiler can package MATLAB-based functions into C++ shared libraries so they can be called in any programming environment that supports C++ functions.

All of our tools follow the same four step process to create a deployed application:

- Examine the application to determine which MATLAB-based files to ship.
- Generate interface (wrapper) functions for the target environment.
- Invoke a target environment specific build tool (like a C++ or Java compiler) to create an executable or software component.

- Assemble the MATLAB-based files and the binary generated in step 3 into one or more files for distribution.

The deployment tools create an application you can install on a machine without MATLAB. But in order to run, the application requires a runtime library (like Java programs require a Java installation). Our runtime library is called the MATLAB Compiler Runtime, or more commonly, the MCR. An installer for the MCR ships with the MATLAB Compiler and Builders. You can redistribute this installer to your end users.

5.2 IMPORTANCE OF THE STUDY TO THE ORGANISATION

- Now a days standalone application creation is required because we can run our executable without a particular software or a platform.
- We can create a deliverable file
- The executable file provide the user interface to interact with application
- Such that nontechnical person can evaluate the application .
- And nontechnical person can view it.

5.3 OBJECTIVES OF THE STUDY

- Now a days standalone application creation is required because we can run our executable without a particular software or a platform.
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5.4 TOOLS AND TECHNOLOGY DESCRIPTION

TOOL REQUIRED FOR PROJECT-

- MATLAB

The MATLAB system consists of five main parts:

The MATLAB language:

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

The MATLAB working environment:

This is the set of tools and facilities that you work with as the MATLAB user or programmer. It includes facilities for managing the variables in your workspace and importing and exporting data. It also includes tools for developing, managing, debugging, and profiling M-files, MATLAB's applications.

Handle Graphics:

This is the MATLAB graphics system. It includes high-level commands for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level commands that allow you to fully customize the appearance of graphics as well as to build complete Graphical User Interfaces on your MATLAB applications.

The MATLAB mathematical function library:

This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

The MATLAB Application Program Interface (API):

This is a library that allows you to write C and Fortran programs that interact with MATLAB. It include facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.

- DEPLOYTOOL TOOLBOX
- MATLAB RUNTIME INSTALLER(MCR)

HARDWARE REQUIREMENTS-

1. RAM- Atleast 4gb
2. OS-Window(x64)/linux/ubuntu

5.5, 5.6 SYSTEM FLOW CHART AND SCREENSHOTS

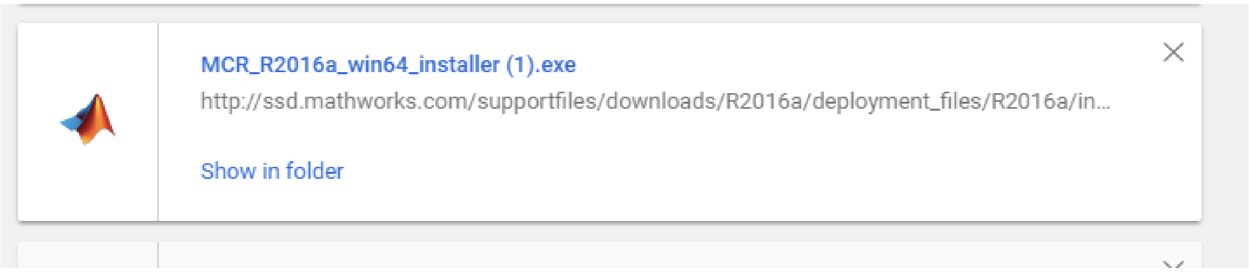
Conversion of m (MATLAB source code) file in the form of .exe (Executable file) file using deploytool in MATLAB.-

Note : Here I am using matlab R2016a

Basic idea of conversion -

- We convert the .m file using matlab deploytool by choosing application compiler as a program for deployment.

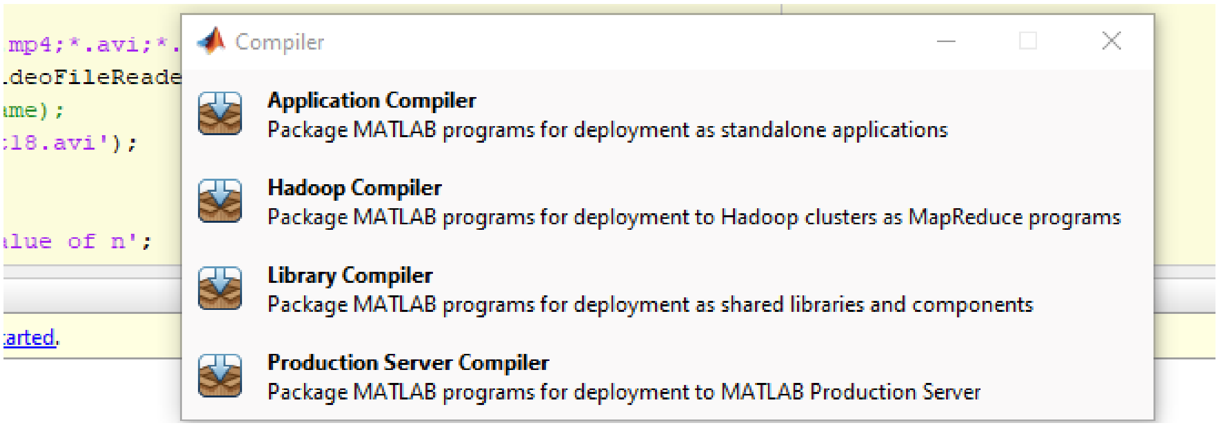
Step 1 – First of all we have to check for the matlab runtime installer because we can run the converted .exe file without matlab by using matlab runtime compiler. you can download the software which was already there on the matlab official site.



MCR_R2016a_win64_installer (1).exe

http://ssd.mathworks.com/supportfiles/downloads/R2016a/deployment_files/R2016a/in...

Step 2 - Now we convert the matlab file into .exe file and for that follow the procedure. Run the command **>>deploytool** in the **matlab**. It Gave The Following output.



Compiler

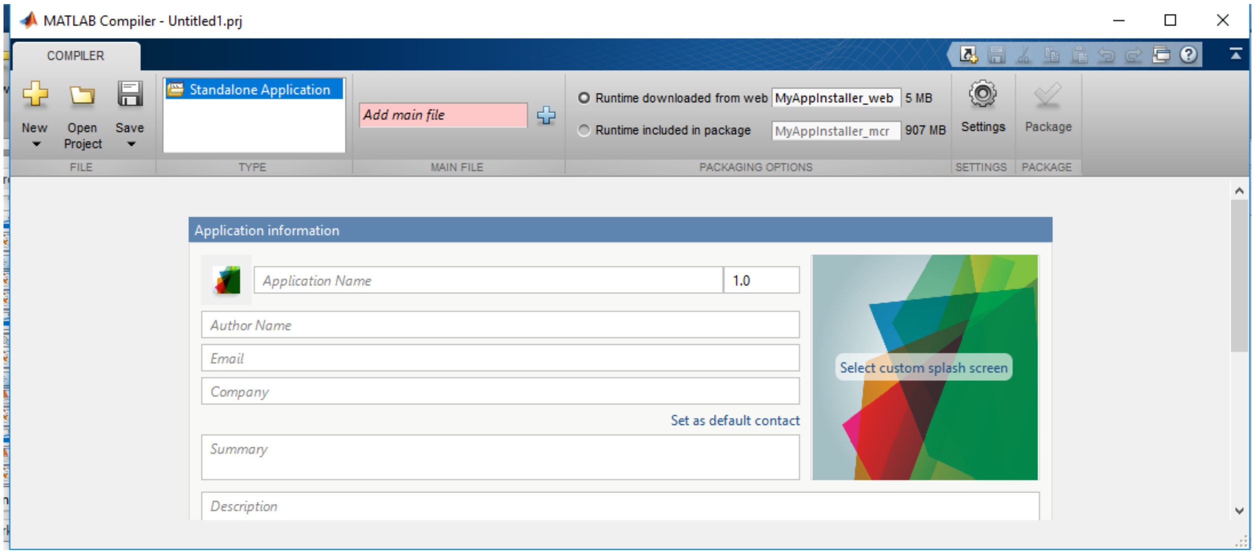
Application Compiler
Package MATLAB programs for deployment as standalone applications

Hadoop Compiler
Package MATLAB programs for deployment to Hadoop clusters as MapReduce programs

Library Compiler
Package MATLAB programs for deployment as shared libraries and components

Production Server Compiler
Package MATLAB programs for deployment to MATLAB Production Server

Step 3- Chose the option application compiler from the given output and again following window will appear on your device .



Standalone Application

Add main file

● Runtime downloaded from web MyAppInstaller_web 5 MB
○ Runtime included in package MyAppInstaller_mcr 907 MB

Application information

Application Name 1.0

Author Name

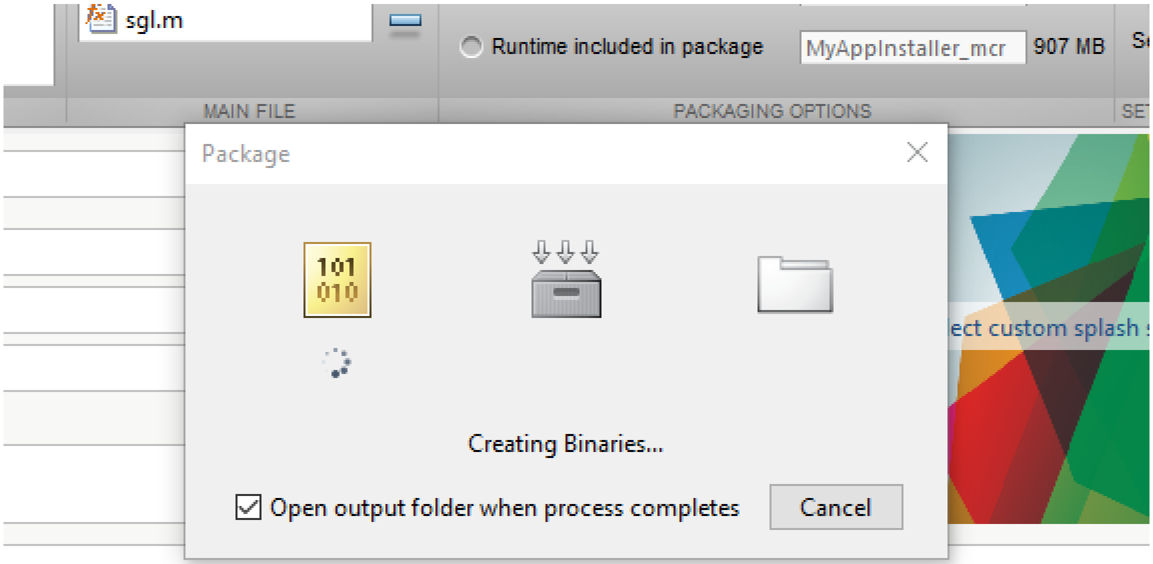
Email

Company

Summary

Description

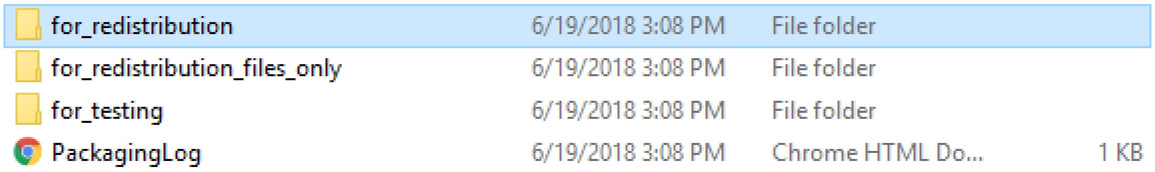
Step 4- add main file which you want to convert into .exe and provide the required information in application information section and press the package button. After pressing the package button conversion will start and open the converted .exe.(here I convert the sgltest.m)



Creating Binaries...

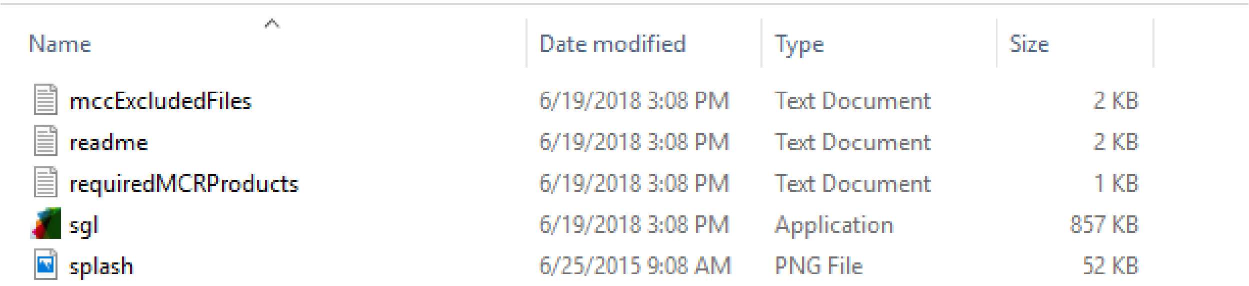
☑ Open output folder when process completes

After finshing the conversion process matlab will open the destination folder.



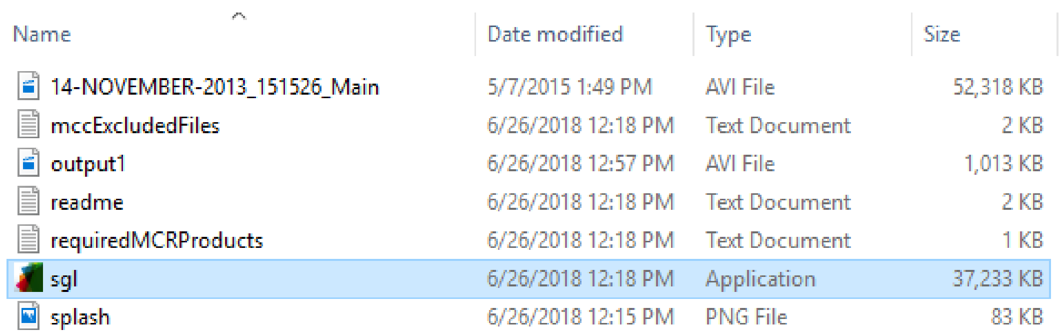
for_redistribution	6/19/2018 3:08 PM	File folder	
for_redistribution_files_only	6/19/2018 3:08 PM	File folder	
for_testing	6/19/2018 3:08 PM	File folder	
PackagingLog	6/19/2018 3:08 PM	Chrome HTML Do...	1 KB

So your converted .exe is ready to use as a standalone application



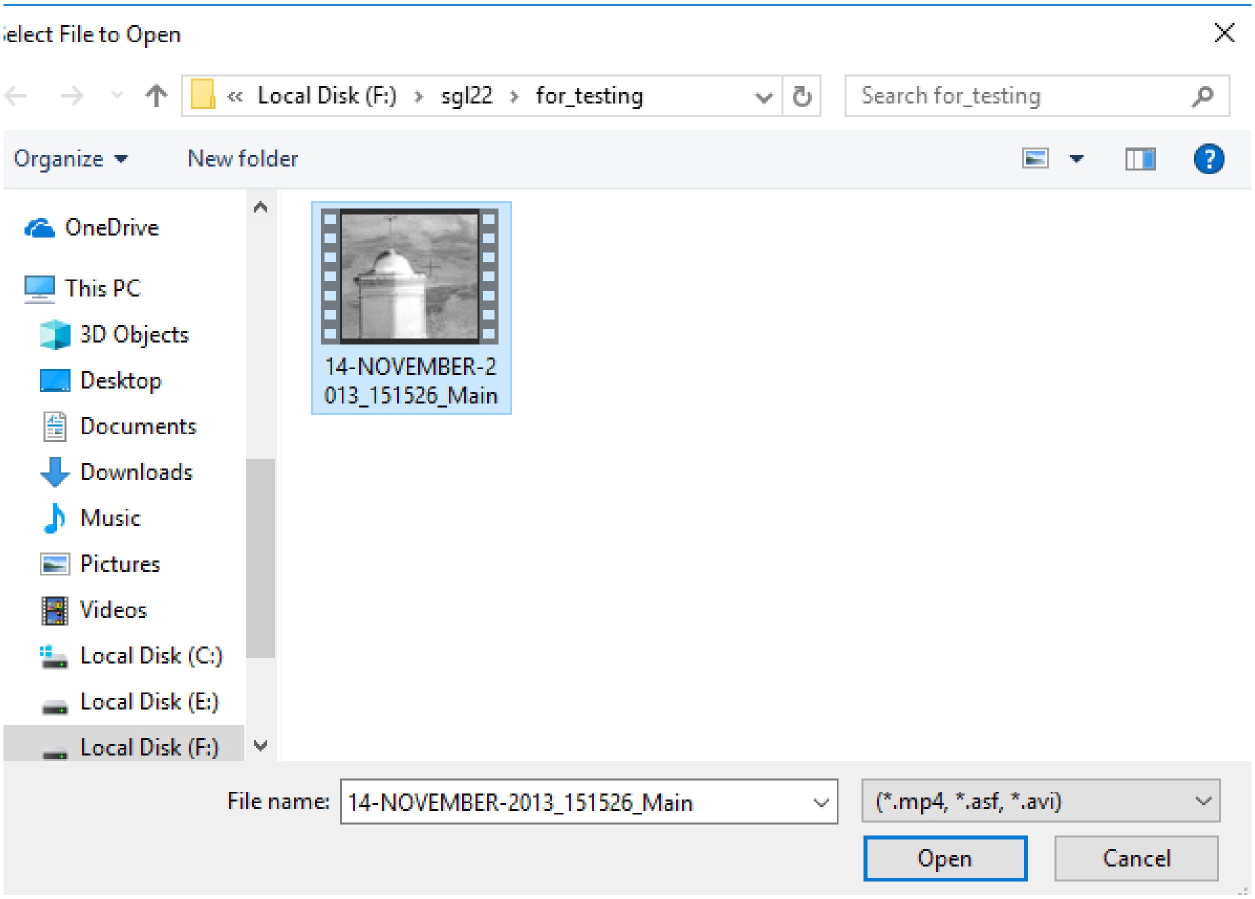
Name	Date modified	Type	Size
mccExcludedFiles	6/19/2018 3:08 PM	Text Document	2 KB
readme	6/19/2018 3:08 PM	Text Document	2 KB
requiredMCRProducts	6/19/2018 3:08 PM	Text Document	1 KB
sgl	6/19/2018 3:08 PM	Application	857 KB
splash	6/25/2015 9:08 AM	PNG File	52 KB

Now you can run the file without matlab, but it is necessary to put a video file over there.



Name	Date modified	Type	Size
14-NOVEMBER-2013_151526_Main	5/7/2015 1:49 PM	AVI File	52,318 KB
mccExcludedFiles	6/26/2018 12:18 PM	Text Document	2 KB
output1	6/26/2018 12:57 PM	AVI File	1,013 KB
readme	6/26/2018 12:18 PM	Text Document	2 KB
requiredMCRProducts	6/26/2018 12:18 PM	Text Document	1 KB
sgl	6/26/2018 12:18 PM	Application	37,233 KB
splash	6/26/2018 12:15 PM	PNG File	83 KB

We are done with our exe, so it's a time to check the exe . run the exe on your device .Now select the video for processing.

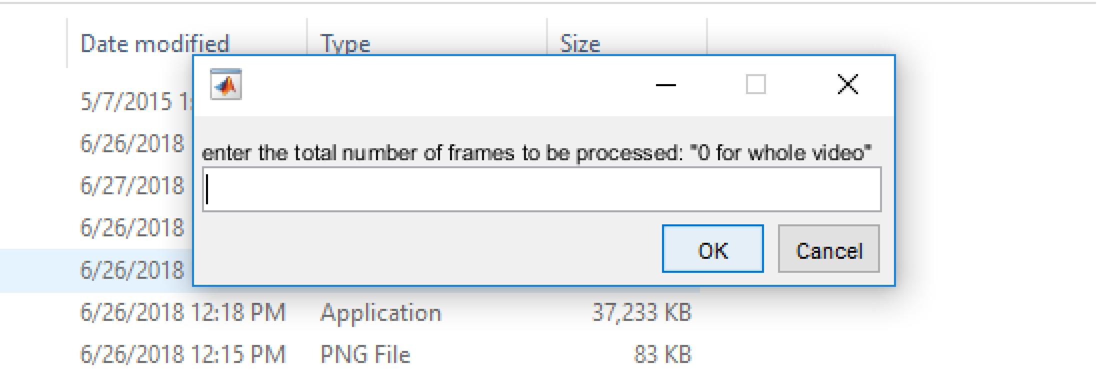


File name: 14-NOVEMBER-2013_151526_Main

(*.mp4, *.asf, *.avi)

You can chose the video of type .mp4, .asf and .avi

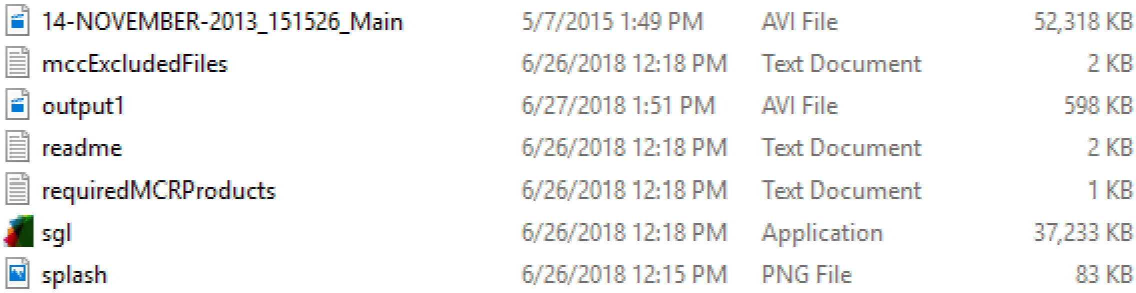
Again another dialogue box appears in that if you chose 0 it processed the whole video else it process according to the sequence of frame.



Date modified	Type	Size
5/7/2015 1		
6/26/2018		
6/27/2018		
6/26/2018		
6/26/2018		
6/26/2018 12:18 PM	Application	37,233 KB
6/26/2018 12:15 PM	PNG File	83 KB

enter the total number of frames to be processed: "0 for whole video"

So after clicking ok on it your processed video is ready as per the requirement.



14-NOVEMBER-2013_151526_Main	5/7/2015 1:49 PM	AVI File	52,318 KB
mccExcludedFiles	6/26/2018 12:18 PM	Text Document	2 KB
output1	6/27/2018 1:51 PM	AVI File	598 KB
readme	6/26/2018 12:18 PM	Text Document	2 KB
requiredMCRProducts	6/26/2018 12:18 PM	Text Document	1 KB
sgl	6/26/2018 12:18 PM	Application	37,233 KB
splash	6/26/2018 12:15 PM	PNG File	83 KB

6.CONCLUSIONS AND LIMITATIONS

Conclusion-

- After converting .m to .exe we can run our exe file without matlab tool.
- Using deploytool we can convert our .m file as a library file, c++ file, c file, java package.
- It is deliverable

Limitation-

- Without matlab runtime installer we cannot run our converted exe in any device.
- We are not able to put our input file at any location.
- Input file must be there in exe folder.

7. APPLICATIONS

- Useful in computer vision.
- useful in machine learning.
- useful in image processing.

8.REFERENCES

- https://blogs.mathworks.com/loren/2010/11/18/deploying-standalone-applications/#2
- https://in.mathworks.com/matlabcentral/answers/84143-how-do-i-convert-my-m-file-into-a-exe-file
- https://nl.mathworks.com/matlabcentral/answers/370440-how-to-convert-a-matlab-app-to-standalone-exe-file
- https://www.mathworks.com/matlabcentral/answers/63723-how-to-convert-matlab-code-to-exe-file
- https://www.youtube.com/watch?v=Ke599czEmxU
- https://www.mathworks.com/videos/getting-started-standalone-applications-using-matlab-compiler-100088.html
- https://stackoverflow.com/questions/1926089/how-to-create-a-executable-exe-file-from-m-file

9. APPENDICES

So at the time of learning the generation of executable file, I found a way of creating visual studio 2010 compatilble dll by using matlab coder toolbox and visual studio 2010. And in this process we also learn the conversion of .m file to c/c++ file.Here I attached the system workflow and related screenshots.

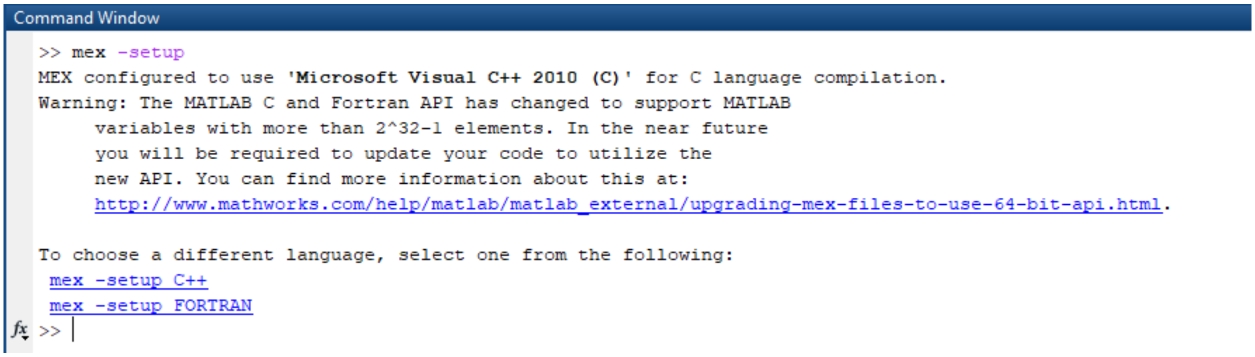
- **Conversion of m (MATLAB source code) file in the form of dll (Dynamic Link Library) file using MATLAB And Microsoft Visual Studio 2010**

Note : Here I am using matlab R2016a

➢ Basic Idea Of Conversion -

1. First we convert the .m function file into the c++(.cpp) by using coder(functionality of matlab)
2. After converting .m into .cpp we build the dll file using Microsoft Visual Studio 2010(x64).

Step 1 - Check that **mingw64** is installed in your matlab or not and for that we use the command **mex -setup** and if the command ran successfully **mingw64** is installed in your computer.



Command Window

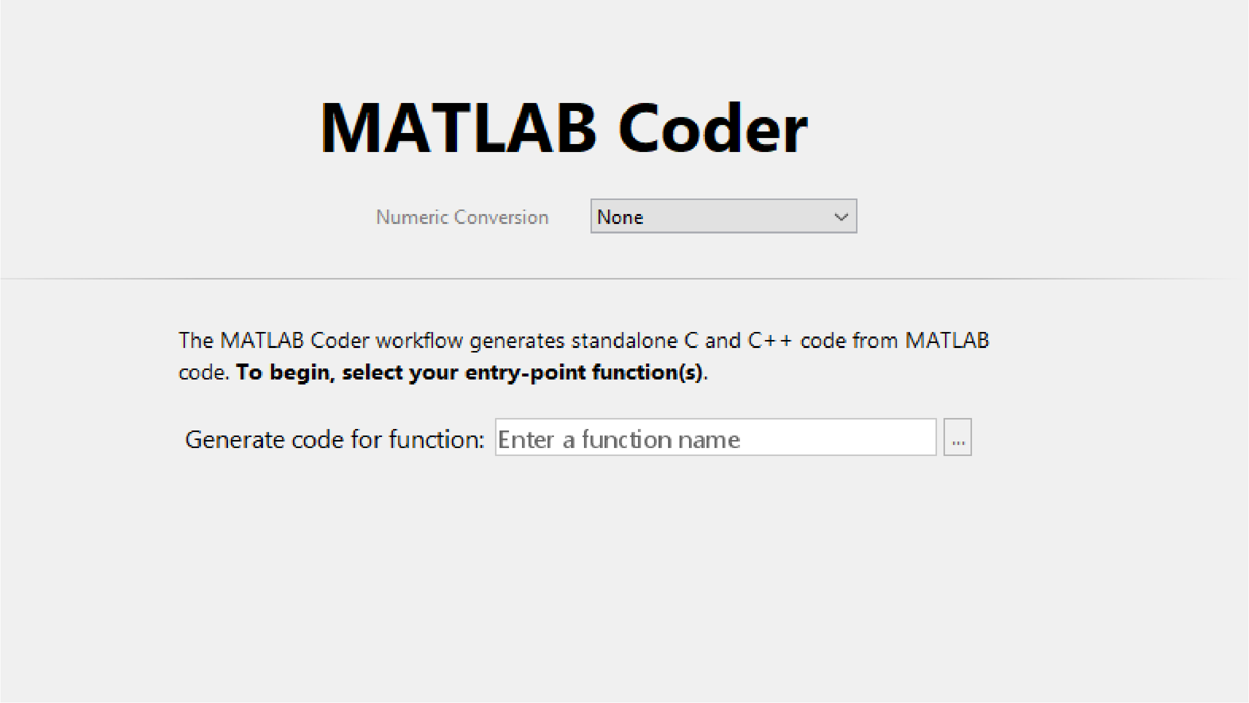
```
>> mex -setup
MEX configured to use 'Microsoft Visual C++ 2010 (C)' for C language compilation.
Warning: The MATLAB C and Fortran API has changed to support MATLAB
     variables with more than 2^32-1 elements. In the near future
     you will be required to update your code to utilize the
     new API. You can find more information about this at:
     http://www.mathworks.com/help/matlab/matlab_external/upgrading-mex-files-to-use-64-bit-api.html.

To choose a different language, select one from the following:
 mex -setup C++
 mex -setup FORTRAN
>> |
```

If there is an error message while running this command, download the **mingw64** and install it on your computer as per the configuration of your computer. After installing **mingw64** on your computer set environment variable locally by using **matlab** and for that run the following command in your **matlab** .

- **>> setenv('MW_MINGW64_LOC',path);**

Step 2 - **(1)** Now we convert the matlab file into C++ file and for that follow the procedure. Run the command **>>coder** in the **matlab**. It Gave The Following output.



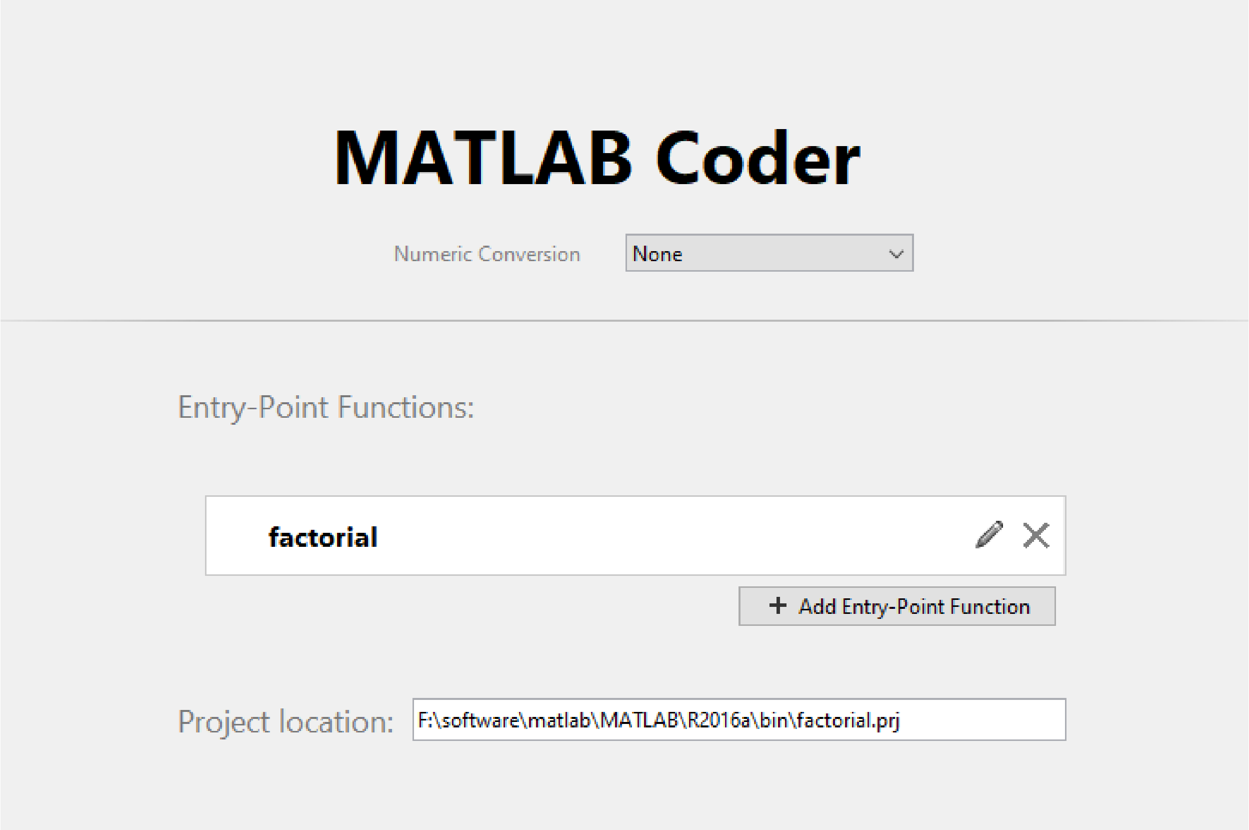
MATLAB Coder

Numeric Conversion: None

The MATLAB Coder workflow generates standalone C and C++ code from MATLAB code. **To begin, select your entry-point function(s).**

Generate code for function: Enter a function name

(2) Now Select the .m matlab function for conversion (Here I select the factorial.m) and click the next button.



MATLAB Coder

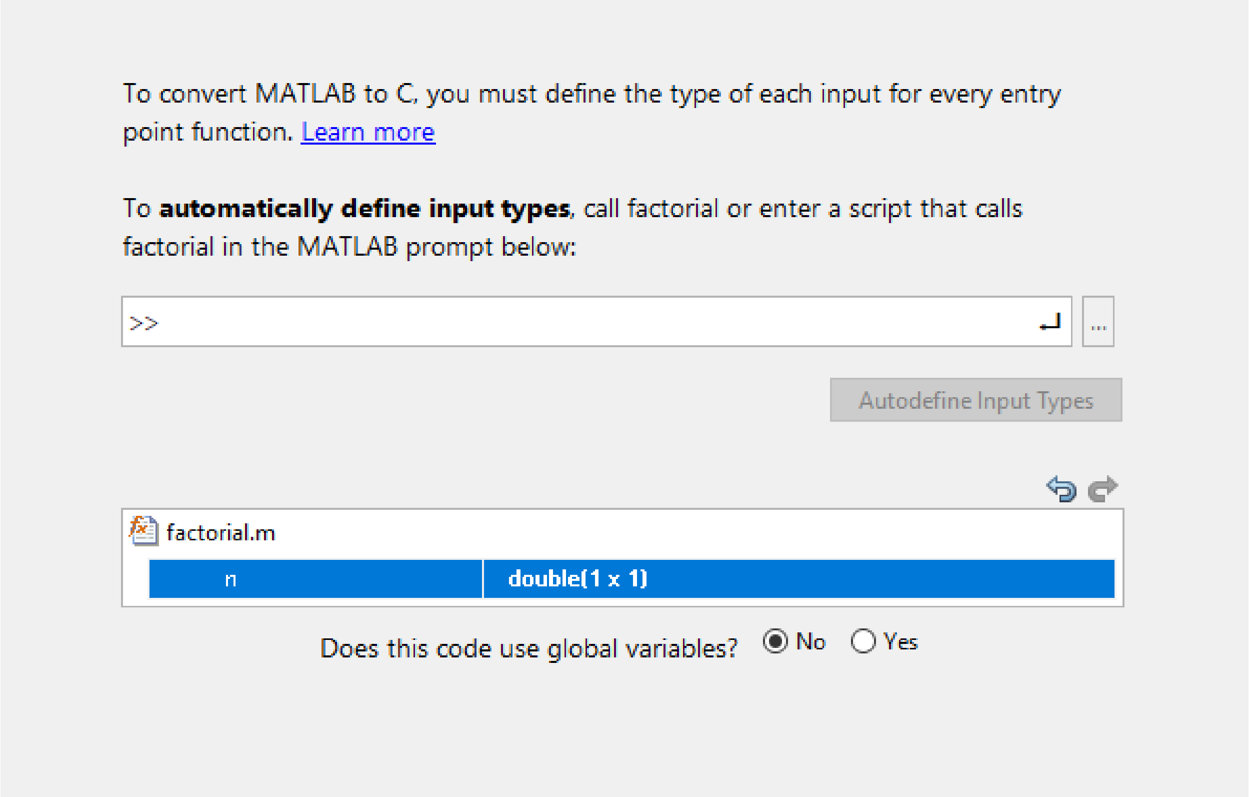
Numeric Conversion: None

Entry-Point Functions:

factorial

Project location: F:\software\matlab\MATLAB\R2016a\bin\factorial.prj

(3) Do The Type Declaration of the used variable in your function and again click the next button.



To convert MATLAB to C, you must define the type of each input for every entry point function. Learn more

To **automatically define input types**, call factorial or enter a script that calls factorial in the MATLAB prompt below:

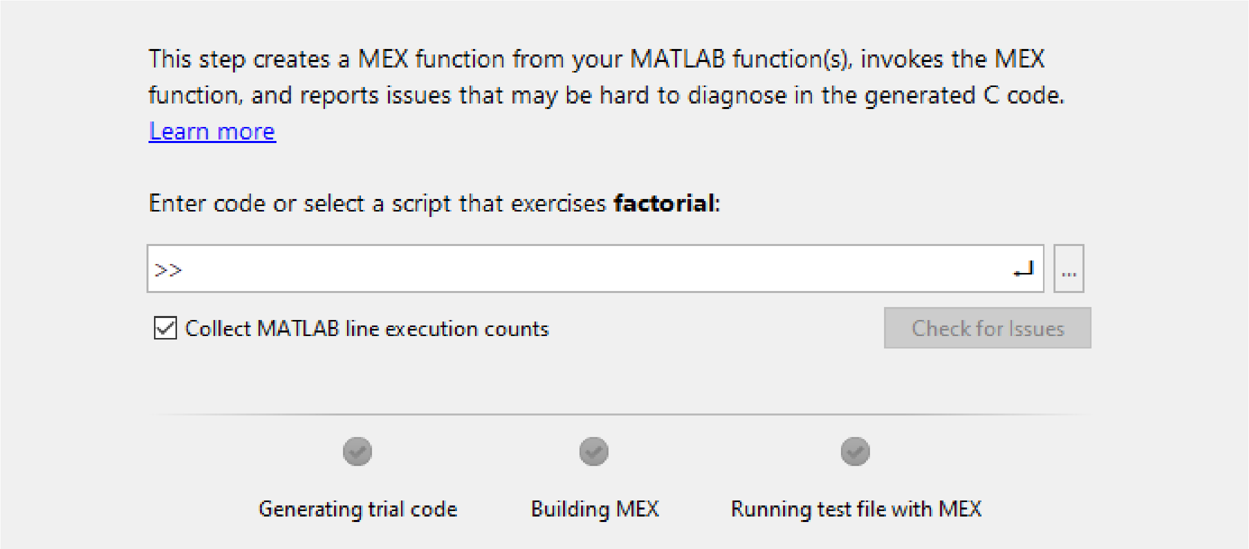
```
>>
```

factorial.m

n	double(1 x 1)

Does this code use global variables? ● No ○ Yes

(4) Now following Window appear in your matlab coder And click the next button



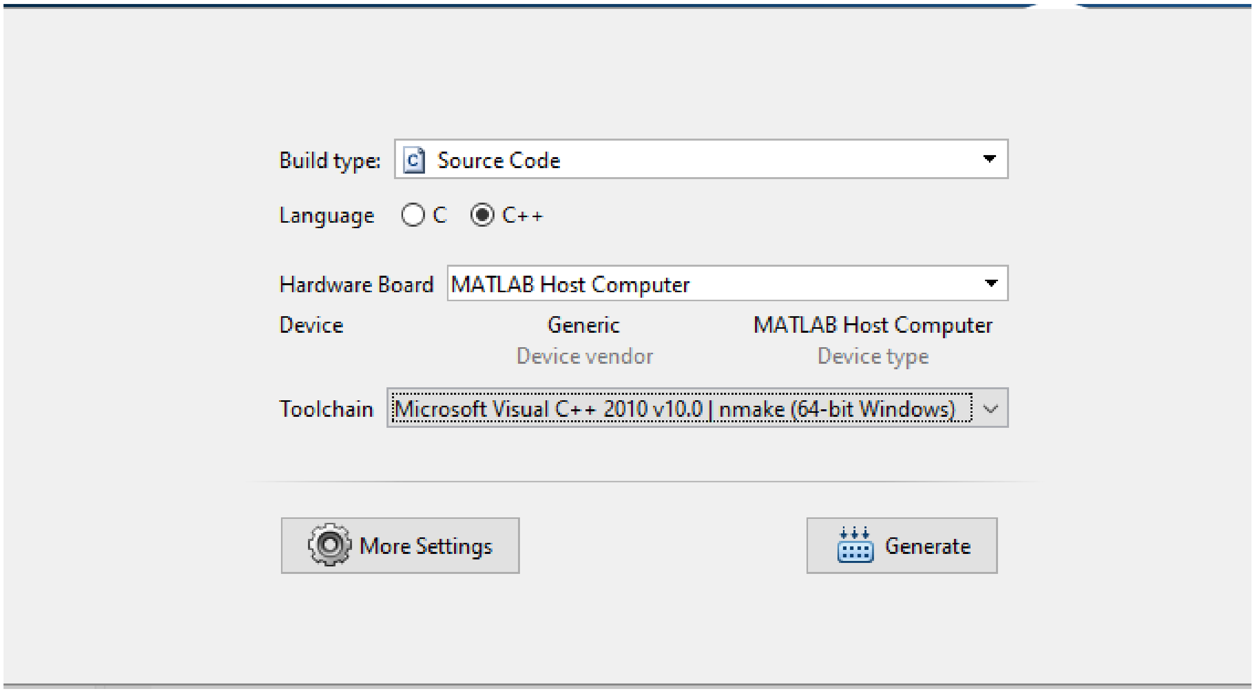
This step creates a MEX function from your MATLAB function(s), invokes the MEX function, and reports issues that may be hard to diagnose in the generated C code. Learn more

Enter code or select a script that exercises **factorial**:

`>>`

☑ Collect MATLAB line execution counts

(5) Now Select the option as per the following screenshot and after that click on the Generate button and your generation for c++ is on the way.



Build type: Source Code

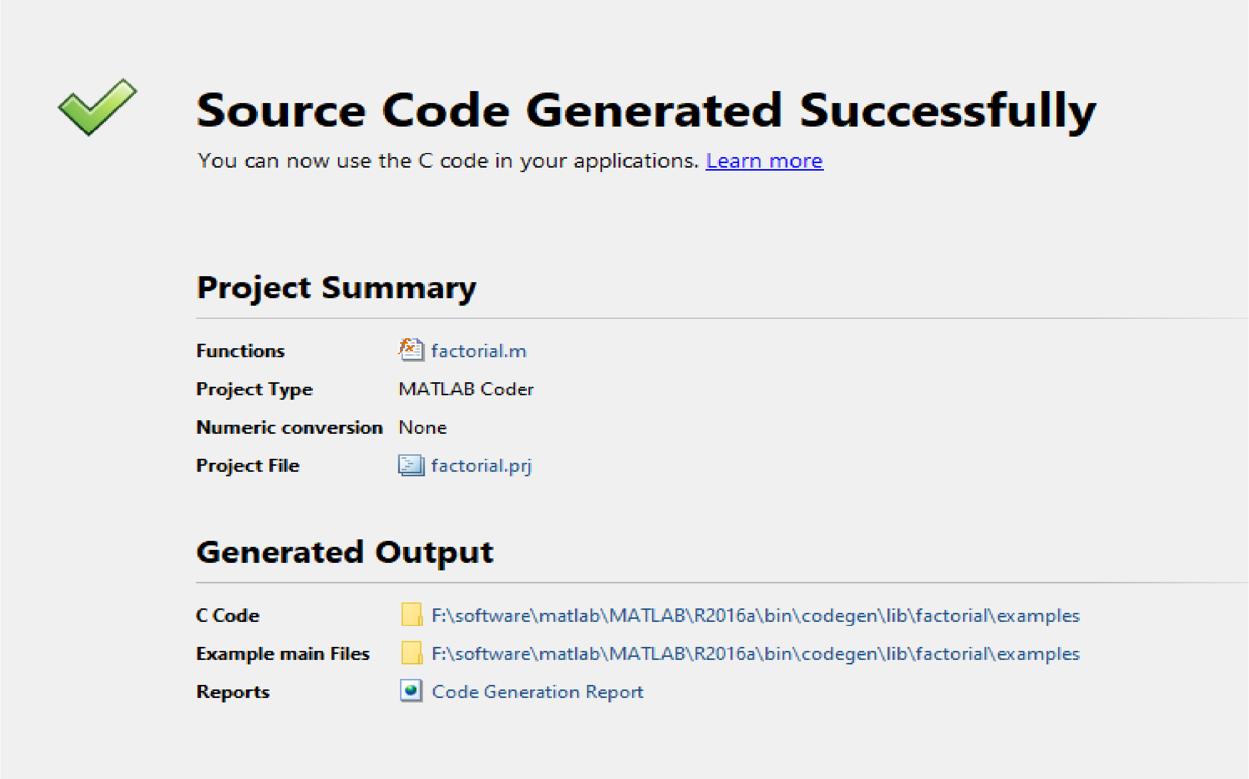
Language ○ C ● C++

Hardware Board MATLAB Host Computer

Device Generic (Device vendor) MATLAB Host Computer (Device type)

Toolchain Microsoft Visual C++ 2010 v10.0 | nmake (64-bit Windows)

(6) after successful conversion following window appear in your matlab coder.



Source Code Generated Successfully

You can now use the C code in your applications. Learn more

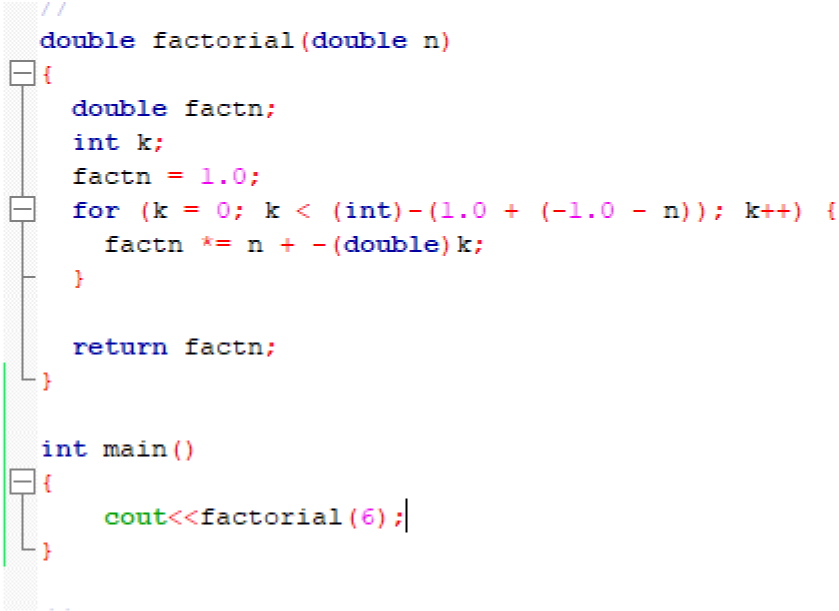
Project Summary

Functions	factorial.m
Project Type	MATLAB Coder
Numeric conversion	None
Project File	factorial.prj

Generated Output

C Code	F:\software\matlab\MATLAB\R2016a\bin\codegen\lib\factorial\examples
Example main Files	F:\software\matlab\MATLAB\R2016a\bin\codegen\lib\factorial\examples
Reports	Code Generation Report

(7) Now conversion is done let check the factorial.cpp file into the **codeblock**, for checking the factorial.cpp open the converted file in the **codeblock** and call the factorial function into your main function and provide some argument to the function.

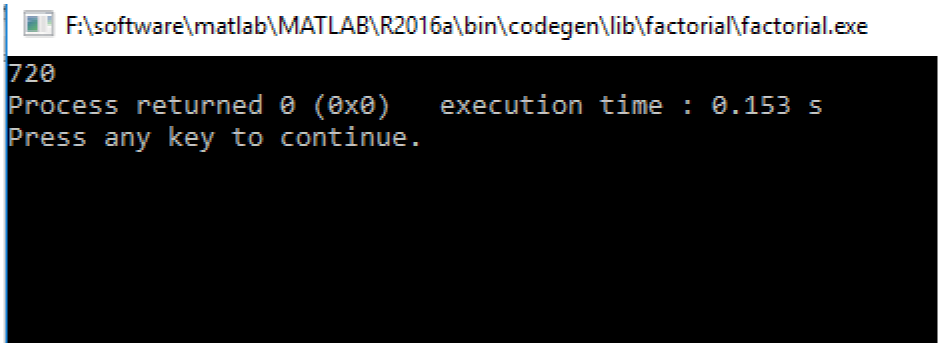


```
//
double factorial(double n)
{
  double factn;
  int k;
  factn = 1.0;
  for (k = 0; k < (int)-(1.0 + (-1.0 - n)); k++) {
    factn *= n + -(double)k;
  }

  return factn;
}

int main()
{
    cout<<factorial(6);
}
```

Function gave the output as per the screenshot.

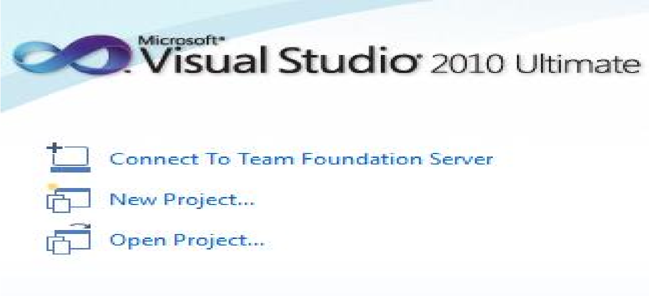


F:\software\matlab\MATLAB\R2016a\bin\codegen\lib\factorial\factorial.exe

```
720
Process returned 0 (0x0)   execution time : 0.153 s
Press any key to continue.
```

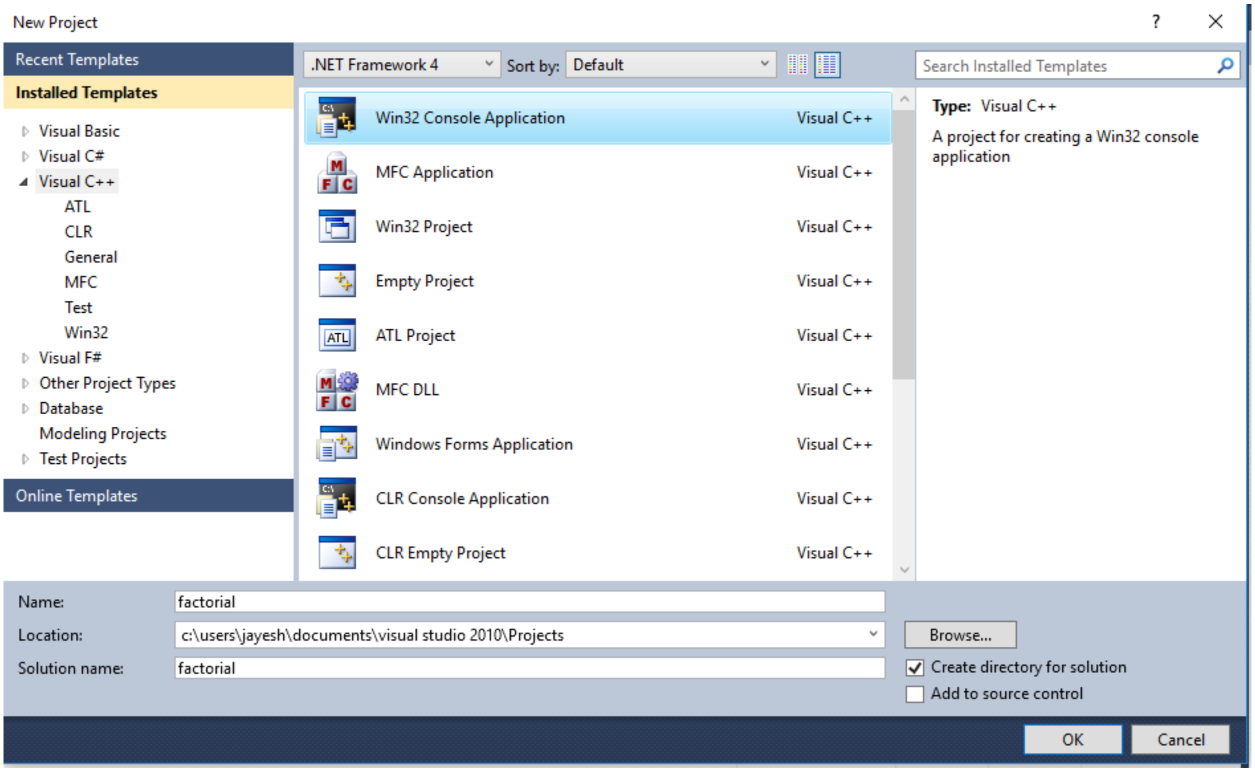
Step 3- In this step we build the factorial.dll file in the visual studio 2010

(1) Open the **visual studio 2010** and create a new project.



Microsoft® Visual Studio 2010 Ultimate
Connect To Team Foundation Server
New Project...
Open Project...

(2) Chose the win32 console application,name the project (here I named it as factorial) and click ok.



Type: Visual C++

A project for creating a Win32 console application

Name: factorial

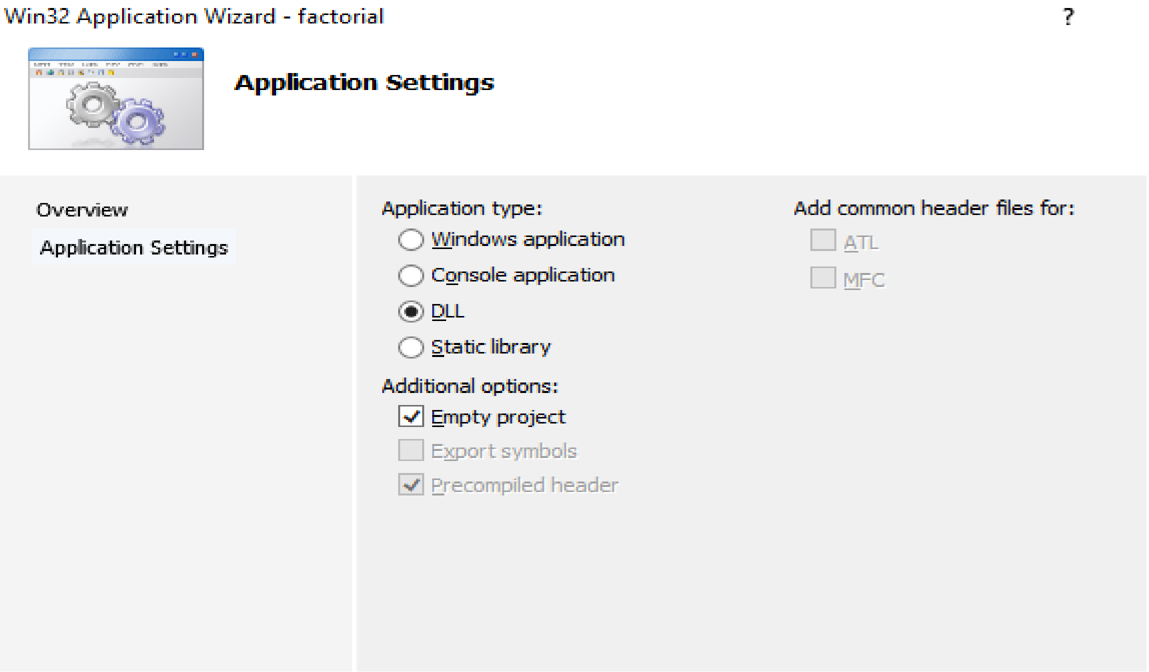
Location: c:\users\jayesh\documents\visual studio 2010\Projects

Solution name: factorial

☑ Create directory for solution

□ Add to source control

(3) Click next and chose the DLL as a application type and select empty project in additional options then click on finish.



Application type:

○ Windows application

○ Console application

● DLL

○ Static library

Additional options:

☑ Empty project

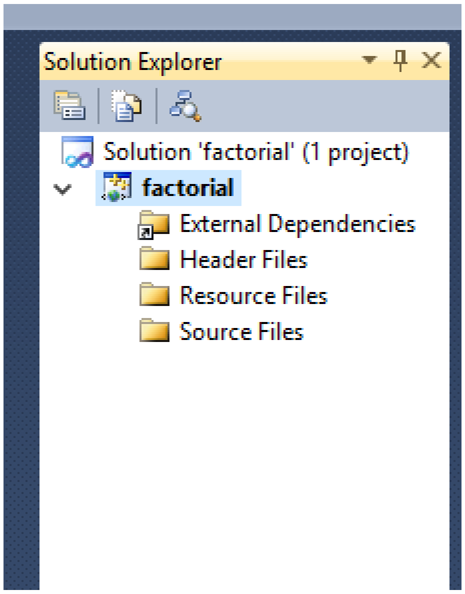
□ Export symbols

☑ Precompiled header

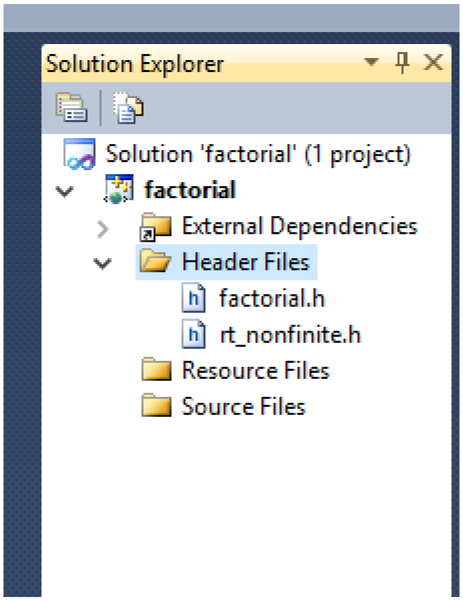
Add common header files for:

□ ATL

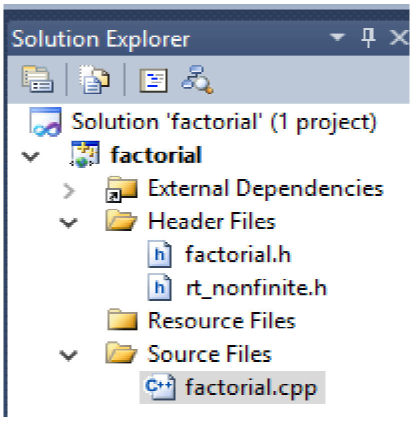
□ MFC



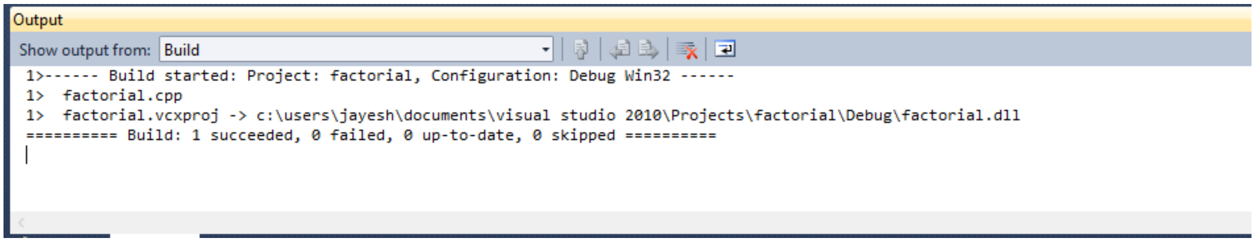
(4) Add the header files(used in our program) by right clicking on header files, In my case there are 2 header files (1) factorial.h (2) rt_nonfinite.h.



(5) Add the source file by right clicking on Source file ,here in my case source file is factorial.cpp.

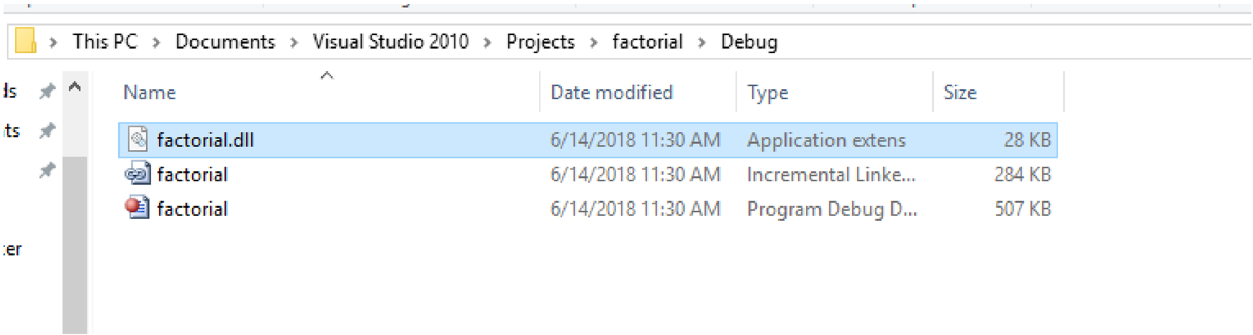


(6) Now build your project.



```
1>------ Build started: Project: factorial, Configuration: Debug Win32 ------
1>  factorial.cpp
1>  factorial.vcxproj -> c:\users\jayesh\documents\visual studio 2010\Projects\factorial\Debug\factorial.dll
========== Build: 1 succeeded, 0 failed, 0 up-to-date, 0 skipped ==========
```

So, your DLL file is ready in your document>>visual studio 2010>>projects>>factorial>>Debug>>factorial.dll(its only the path of my project file it may vary as per path).


This PC › Documents › Visual Studio 2010 › Projects › factorial › Debug

Name	Date modified	Type	Size
factorial.dll	6/14/2018 11:30 AM	Application extens	28 KB
factorial	6/14/2018 11:30 AM	Incremental Linke...	284 KB
factorial	6/14/2018 11:30 AM	Program Debug D...	507 KB

Now you can use your DLL file.