

AN INTERNSHIP REPORT
on
EMBEDDED C PROGRAMMING FOR
AVR GPIO

Submitted by

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ACKNOWLEDGEMENT SECTION

Certified that internship report entitled **“EMBEDDED C PROGRAMMING FOR AVR GPIO”** is a bonafide work carried out in the sixth semester by **“KAVIYA E”, “SARATHKRISHNAN R”, “VANIPRIYA V”, “VISHALINI S”, “DHARANEESH M”, “KAVIN P”** in partial fulfillment for the award of Bachelor of Engineering in Electronics and Communication Engineering from Shree Venakateshwara Hi-Tech Engineering College during the year 2022-2023.

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COMPANY BACKGROUND INFORMATION AND LEARNING OBJECTIVES

Founded in 2010, EMBUZZ Technologies Private Limited started for Innovating new experience in the expertise technologies such as **Embedded Systems, Robotics, Artificial Intelligence, SCADA, IOT, Automation, Data Science, Web Design & Development** etc...

The Aim is to provide excellent services to our customer for our products and relevant guidance for our candidates (Corporate Employees and Students) to enhance their skills and grow with us. Our secret of success and our strength is, we never try to convince our customers with “Quantity” but “The Quality”.

Their Foot in Sectors...

✓ *Product development*

- Industrial Automation
- Biomedical products
- Product based on Applications
- Avionics
- Axial and Movable Robots and Mechatronics Design and Fabrication.
- Logo, Web Design, Hosting and Development.

✓ *Career Development for Corporate as well as Academic Candidates Via*

- Research and Development Labs @ Educational Institutions
- Entrepreneurship Development labs
- Professional Training
- Value Added Training
- Industrial visits
- Workshop

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1. INTRODUCTION TO EMBEDDED SYSTEMS

Embedded Systems

FIRST MICROPROCESSOR-Intel 4004 Specifically designed for CALCULATOR by the Intel Corporation 1971.

In 1978's, National Engineering Manufacturers Association had released a "Standard" for programmable Microcontroller.

After 1980's, The common components used externally in the processors has been integrated into a single chip named as Controller.

DEFINITION

Embedded System is the Combination of Hardware and Software to perform a Specified task repeatedly. Also called as Single Chip Microcomputer. The components required for the particular functions are available in Single chip. It has two types

1. Simple Embedded Systems
2. Complex Embedded Systems

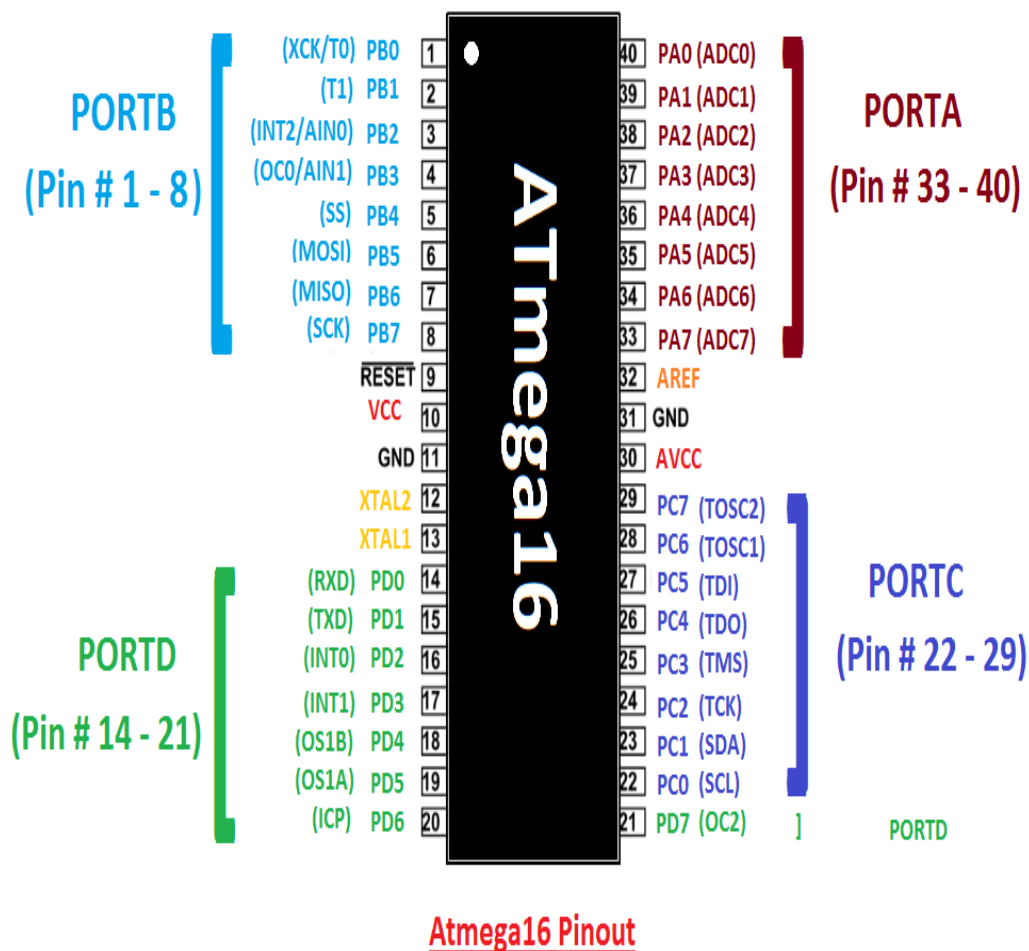
SHORT LIST OF EMBEDDED SYSTEMS

- ❖ Anti-lock Brakes
- ❖ Auto Focus camera
- ❖ Automatic Teller machine
- ❖ Automatic Transmission
- ❖ Cell Phones
- ❖ Factory Control
- ❖ Fingerprint identifiers
- ❖ Home Security Systems
- ❖ Satellite Phones
- ❖ Temperature Controllers
- ❖ Theft Tracking Systems(TTS)
- ❖ Printers & Scanners

2. ATMEGA16 ARCHITECTURE

To support different design requirements and reduce cost, the ATMEL AVR family has many microcontrollers like ATMEGA 8515, ATMEGA 16 etc...

Microcontrollers in the 8 bit AVR family share a similar instruction set & Arch. The ATMEGA 16 has components that are useful for typical microcontroller applications such as, ADC and PWM.



3. EMBEDDED C PROGRAMMING

C is a high level programming language. C code is easier to understand compared to other languages. C supports low level programming, we can use C to access all hardware components of the microprocessor.

C has Standard libraries for complex tasks. Data type conversions, Standard input and output, long integer Arithmetic.

The Atmel AVR instruction Set is designed to support C compiler. C code can be converted efficiently to assembly code.

C-Data types and operators

The main data types in C are

Char : 8 bit integer in AVR
Int : 16 bit integer in AVR
Longint : 32 bit integer in AVR

C-Flow Control

By default, C statements are executed Sequentially
To change the program flow, there are six types of statements.

If else statement
Switch statement

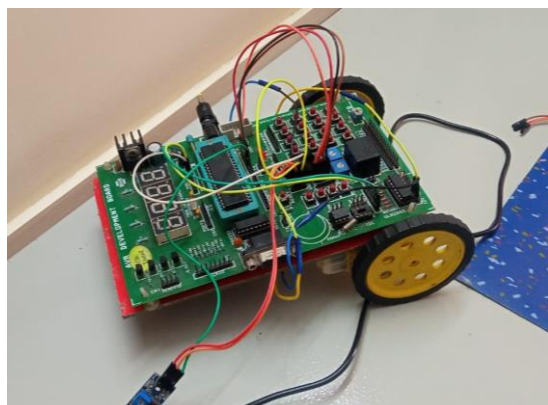
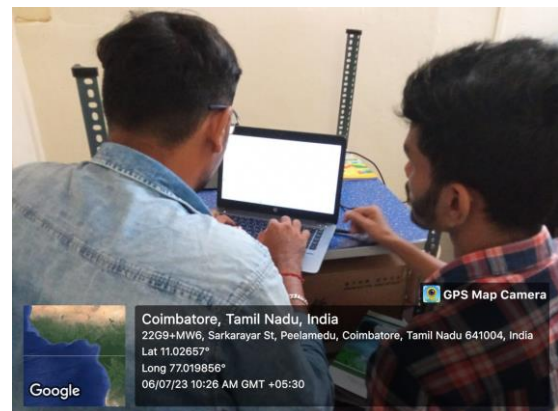
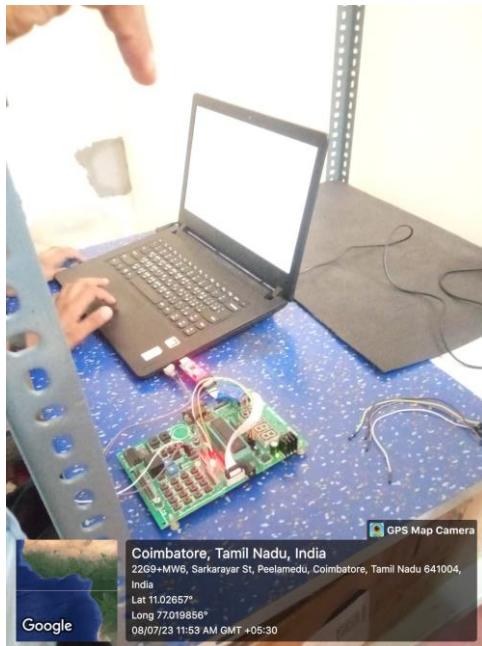
While statement
For statement
Do statement

Goto statement

I/O PORT REGISTERS

- DDR(Data Directional Register)
- PORT
- PIN

4. IMPLEMENTATION & PROJECT IMAGES



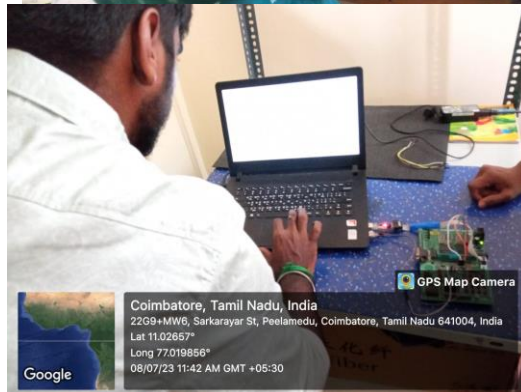
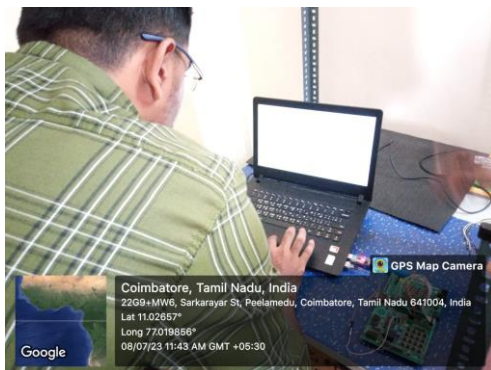
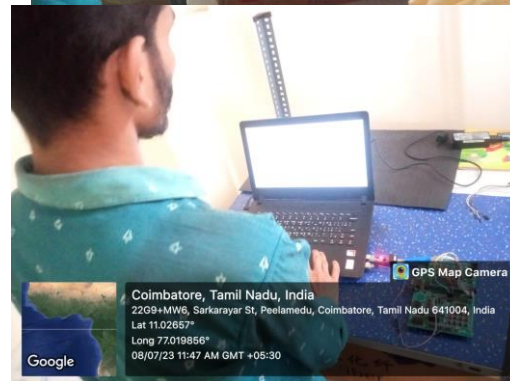
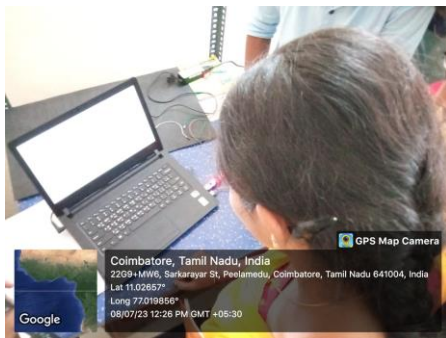
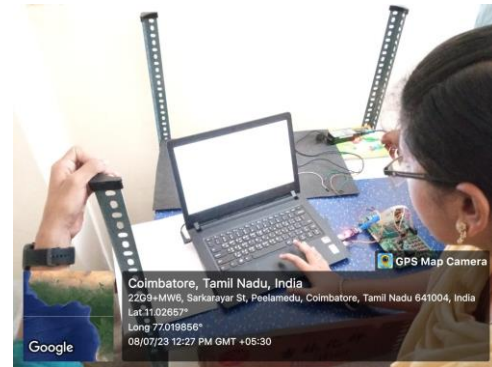
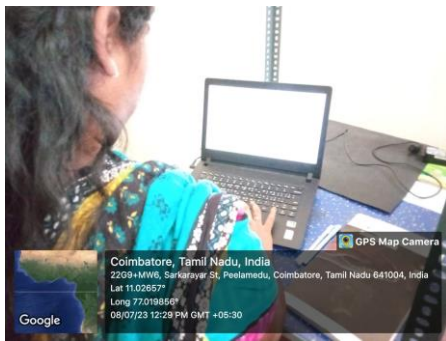
5. SOURCE CODE

Line Follower ROBOT

```
#include<avr/io.h>
#include<util/delay.h>
int main(void)
{
    DDRB=0X0F;
    for(;;)
    {
        PORTB=0X01;
        _delay_ms(100);
        PORTB=0X02;
        _delay_ms(100);
        PORTB=0X04;
        _delay_ms(100);
        PORTB=0X08;
        _delay_ms(100);
        PORTB=0X00;
        _delay_ms(100);
    }
}
```

```
-----
#include<avr/io.h>
#include<util/delay.h>
int main(void)
{
    DDRB=0X0F;
    while(1)
    {
        PORTB=0X01;
        _delay_ms(100);
        PORTB=0X02;
        _delay_ms(100);
        PORTB=0X04;
        _delay_ms(100);
        PORTB=0X08;
        _delay_ms(100);
        PORTB=0X00;
        _delay_ms(100);
    }
}
```

6. GEOTAGGED PHOTOS



7. CERTIFICATES

