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Steffen Block

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Diplomica GmbH
Hermannstal 119k
22119 Hamburg

Fon: 040 / 655 99 20
Fax: 040 / 655 99 222

agentur@diplom.de
www.diplom.de

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ii ABSTRACT

The project aim was to a built a robot, controlled by a PIC microcontroller to follow a line completely autonomously and as quickly as possible. The robot meets the requirements from the "RoboRama Contest" (www.dprg.com), followed a T-shape course, and obtained more (safety) features. Different kinds of design features and digital algorithms were developed and tested, in order to achieve the best results.

Applied project management techniques and used key skills, guaranteed the successful completion of the project, in the design and construction of hardware and software technologies.

The hardware was based on a block structure with infrared sensors at the front of the vehicle. Their analogue signals were transferred to digital logic with a comparator. This information used a PIC 16F84A microcontroller to control the movement and direction of the robot with pulse width modulation (PWM). All parts were mounted on a chassis, implemented with a mechanical construction set. Batteries of 9V provided the necessary power supply.

Adjustments were done through iterative steps, to come to the final result of the robot system. The main adapted design feature was the motor and steering system. First of all a separate servomotor for the steering and a single DC motor for the forward movement was fixed. Through implemented and first testing steps, this resolution lacked the required performance. Hence, the design changed to two DC motors, which offered a satisfactory solution.

The electronic circuit was designed with the computer aided design tool Proteus and executed as a strip line board.

The software algorithm development started with the truth table to reduce the possible events from thirty-two to the eleven applied conditions. The generated flowchart gave the program a structure and applied the truth table decision in different PWM generations. Finally, the software was written in assembler language and implemented on the PIC.

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vi LIST OF ABBREVIATIONS

DC	**Direct Current**
DIP	**Dual Inline Package**
DPRG	**Dallas Personal Robotics Group**
CMOS	**Complementary Metal Oxide Semiconductor**
EEPROM	**Electrically Erasable Programmable Read Only Memory**
FR	**Front Sensor**
ICD	**MPLAP In-Circuit Debugger from Microchip**
ICE	**MPLAP In-Circuit Emulator from Microchip**
IDE	**MPLAP Independent-Development Tool from Microchip**
IEE	**Institution of Electrical Engineers**
I/O	**Input / Output**
IT	**Information Technology**
LI	**Left-Inside Sensor**
LO	**Left-Outside Sensor**
PCB	**Printed Circuit Board**
PIC	**Peripheral Interface Controller**
PWM	**Pulse Width Modulation**
QTY	**Quantity**
RAM	**Random Access Memory**
RI	**Right-Inside Sensor**
RISC	**Reduced Instruction Set**
RO	**Right-Outside Sensor**
ROM	**Read Only Memory**
R.P.M.	**Revolution per Minute**

T.T. **Truth Table**

VAT **Value Added Tax**

vii LIST OF SYMBOLS

f	**Frequency [Hertz = Hz = s^{-1}]**
I	**Current [Ampere = A]**
l	**Metre [m]; Millimetre 1/1000 of a meter [mm]**
t	**Time [seconds = s];**
	Millisecond 1/100 of a second [ms]; Microsecond 1/1000 of a second [µs]
T	**Period time [seconds = s]**
v	**velocity [meter per second = m/s]**
V	**Voltage [Volt = V]**
′	**Foot [30.48 cm]**
″	**Inch [2.54 cm]**